The Economics
OF
Poultry Management

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The Economics
OF
Poultry Management

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Preface

For many years, through reading, writing, listening, teaching, research, extension, observation, and practical operation, I have gained the impression that the costs of doing business in the practical field of poultry husbandry are not always well known. For years at a time poultry husbandry appears to be a favorable financial venture, and at other times it does not. The unfavorable periods may extend for several years, for one year, or for part of a year. Future procedure on many poultry farms is too often decided and predicated upon what is happening currently.

Because of this there is need for collating costs of various operations in poultry management, the effect of years and regions on these costs, and some of the basic reasons for costs, returns, and changes in them which occur from time to time.

Although it is true that the period at which one is born may influence greatly his success or failure in poultry husbandry as well as in other types of farming, it is also a fact that knowledge of various economic conditions as they pertain to poultry management should guide one to a better-than-average business at any time.

This book is prepared as a guide for those who are or expect to be students of their poultry business and who wish to examine and make plans for the future in the light of what has gone before, what now is, and what is likely to be. It is designed for the high school or college student and the practical poultryman alike.

Vision is an important attribute for anyone and, therefore, is important to an operator in poultry husbandry, but vision without the support of basic facts may produce merely a dreamer and possible disaster. It is my hope that the facts here presented may aid in preventing such eventualities.

I have long had a desire to tackle this job, having been inspired to do so from sitting at the feet of a great teacher and lecturer, Professor James E. Rice, and having later been associated with him for many years as a member of the Department of Poultry Husbandry at Cornell University. Further stimulation was received from courses in the Department of Agricultural Economics at Cornell, the first of which

were taken about 1916 and the last in 1940. For many years continuing to the present, facts learned have been studied, taught, and practiced on my poultry enterprise near Ithaca, New York.

I wish to express appreciation to many persons throughout this and other countries who by their bulletins, letters, and in other ways have provided material. Credit has been given in all cases.

Special acknowledgment is made to Drs. Wendell Earle, C. D. Kearl, E. G. Misner, F. A. Pearson, G. P. Scoville, and S. W. Warren of the Department of Agricultural Economics at Cornell University, each of whom read portions of the manuscript and was most helpful in many ways, and to Mr. F. E. Andrews, Dr. J. H. Bruckner, and Professors L. M. Hurd and L. E. Weaver of the Department of Poultry Husbandry at Cornell University for many suggestions

H. E. Botsford

Ithaca, New York
April, 1952

Contents

I · Commercial Development of the Poultry Industry in the United States

Poultry appear to be the oldest of all livestock. Specialized poultry breeding started about 2000 years ago. The great strides in poultry husbandry have been paced by the desire of man for wholesome, appetizing, and nourishing foods.

The improvement in methods is predicated on the profit motive. Man's desire to accomplish more of something worth-while with less effort and cost is exemplified in poultry husbandry.

Good advice on poultry husbandry written 100 years ago is being stressed and violated today.

The first college instruction in poultry husbandry in this country was in 1891–1892. James E. Rice of Cornell University was the teacher.

The first college department of poultry husbandry was at the Connecticut Agricultural College (now University of Connecticut) in 1901. F. H. Stoneburn was appointed head of the department.

Poultry increased in value but decreased in numbers in the United States between the 10-year average period 1938–1948 and 1950.

Of the 5 million United States farms reporting chickens in 1940, 99.8 per cent had fewer than 1000 chickens.

Of all farms in the United States reporting chickens in 1940, 0.036 of 1 per cent, or 1913 farms, had more than 2500 chickens.

Of all United States farms 4.7 per cent were specialized poultry farms in 1945.

Specialized poultry farms contributed 48.3 per cent of the value of all poultry and poultry products sold in 1945.

The history of poultry is older than humanity itself. Referring to Genesis, 1:21, we find, "God created ··· every winged fowl ···." In 1:22, the command is given to let fowl multiply in the earth. (Fowl multiply by producing and hatching eggs.) This was during the fifth day. On the next day cattle and other beasts and finally man were created. Elsewhere the Bible is credited with the statement that a thousand years are but a day. It appears, therefore, that poultry are the oldest of all livestock and that they even precede man by 1000 years or so, that the chicken came before the egg, and that the various fowl were named before woman arrived on the scene (Genesis, 2:20–22).

The supposed site of Eden is near the north end of the Persian Gulf and near Ur, the home of Abraham. It would have been comparatively easy for fowl to be carried by traders to India and Malay. There, in the jungles, *Gallus bankiva* exists in the wild state and is thought to be the ancestor of some of our modern breeds of poultry.

Fowl also found their way to the Orient, and it is thought that the Aseel or Malay fowl are the ancestors of our Asiatic breeds.

Poultry have been found in lands never before visited by civilized man. It seems evident that other peoples hundreds of years earlier may have had a hand in the spread of fowl.

Poultry husbandry is an old art, and, although science has shown increasingly greater progress during the past century and a half, inquiring minds apparently discovered the favorable qualities of poultry very early. K. T. Wright in *Michigan Agricultural Experiment Station Bulletin* 294, July 1938, states: "The earliest actual reference to poultry states that the Chinese Emperor Fu Hsi, who lived from 3341 to 3227 B.C., taught his people to breed fowl. Domestic fowl were mentioned by Peisthetaerus of Persia about 500 B.C. and by Nehemiah of Palestine about 445 B.C. Aristotle, who wrote about 350 B.C., speaks of fowl as familiarly as would a natural historian of the present time."

Wright also states: "Apparently specialized poultry breeding and production were first developed in Italy about 2000 years ago, principally to meet the demand for food supplies when Rome was mistress of the world."

This statement gives the underlying cause for the spread and success of poultry husbandry, namely, the value of poultry and eggs as human food. It is in the production of this well-nigh indispensable food for the human race that poultrymen are engaged and in which we are economically interested in this book.

Two statements, published in 1904,[1,*] as true today as then, are worthy of thought: "To make the business successful, a man must be an expert in the management of fowls, and must have good business judgment, with enough business training to make him accurate, methodical, and prompt in his work and dealings." "Many of the successful poultrymen of today were not experts when they began." The truth of ideas like these is evident to the student of poultry husbandry. We can look about us today with a realization that the tremendous change in methods and the expansion in the industry has resulted from the interest and ability of men and women who believed intensely in the future of poultry husbandry as a business and who were keen thinkers and observers. Fundamental truths had to be uncovered. These truths were always

* Superior numbers refer to bibliography at ends of chapters.

there and basic, although it has taken research and trial and error to discover many of them. In the process, many supposed truths had to be discarded. Others, dormant and useless for many years, have pushed forward subsequent to the discovery of other truths that necessarily had to precede them.

Lessons taught from the hard course of practical experience and the never ending desire of research workers to seek out truths have worked wonders in poultry husbandry. To many modern poultrymen the problems that were current at the beginning of the century appear trivial, purely because we know the answers to them. Today, however, poultrymen are puzzling over and research workers are busy with other problems just as baffling. With the background that exists, we find the advances and methods being used by poultrymen, the scope and results of research, and the importance that the industry has assumed in the procedures of states and nation little short of marvelous. The true poultryman knows, however, that the possibilities are far from exhausted and is ever alert to methods and findings, secure in the knowledge that his work is fundamental to the proper nutrition of people and is, therefore, filling a distinct human need.

Professor James E. Rice said years ago: "Man has scarcely begun to understand and appreciate the true significance of the universal popularity of eggs, and to recognize the real reason for their extensive consumption. This lies in their possession, to a large degree, of essential food nutrients, combined with an attractive flavor." He placed eggs with milk and leafy vegetables under the heading of "the three protective foods."

"We may well congratulate ourselves," said Rice, "that we are engaged in an occupation which has as its principal object the production of an essentially indispensable food for the up-building of the human race."

It is well that many ideas of the past were tested on farms belonging to wealthy persons whose fortunes were made in the larger financial industries of those times and to whom failure of an idea meant little monetarily. *Then*, private capitalists tested ideas because of the fascination poultry had for them from both the practical and the exhibition viewpoints. *Subsequently*, state and national funds greatly increased the number of those taking part in research. As the opportunities for profit become more evident, many poultrymen are investing funds and testing ideas, but on a more sound and certain basis than has heretofore existed.

Man's right to superiority over other animals on earth is demonstrated by the thoughts and ideas that he is putting into practical appli-

cation. Sometimes startling are the ingenuity and originality of man in devising methods to make useful and remunerative the natural qualities possessed by the domestic fowl. Observation of many well-known and less well-known poultrymen widely distributed over the country will serve to substantiate this.

Development of Poultry Methods

In 1871 W. M. Lewis in his *The People's Practical Poultry Book* describes a South American poultry farm operated prior to 1870 by Señor Don San Fuentes on his 7500-acre farm. A condensed description follows:

> Each 50 hens and 2 cocks have an A-shaped, thatched roof pole house. These houses, 600 or 700 of them, are placed 200 feet apart. Hatching is done with hens in the room of a building near the dwelling where some 300 boxes accommodate the sitting hens. At hatching, 1 hen takes 2 broods which when left by the mother are taken to their future 50-bird home. They are given free range, but confined on rainy days. They stand confinement well, with hardly any decrease in eggs laid, but are given an extra allowance of animal food.
>
> Six thousand layers are kept; 1 man and 4 boys do the work. Houses are cleaned weekly and whitewashed each 3 months. Eggs are gathered at evening by the boys and average 200 dozen per day the year around. Sales are 72,000 dozen of eggs; 20,000 chickens and 2-year-olds.
>
> The profits from one year's business amounted to $11,000. Sr. San Fuentes is satisfied, says Lewis, and intends to double his stock each year until every 200 feet of his extensive farm has its house of 50 tenants.

Commercial Hen Hatching and Rearing

Similar systems were employed in the United States in the early 1900's. Poultry magazines of that day carried stories and pictures of poultry farms around Little Compton, R. I., where houses holding 35 birds were placed a few rods apart. Eggs were hatched by hens in tiers of nests banked together in a large room, and the chicks were brooded by hens.

In *Principles and Practices of Poultry Culture*, John H. Robinson (1912) states:

> One farmer in this district, who maintains a stock of about 2000 laying hens and gives little attention to geese or cows has made the statement that for a number of years he has been able to live well and still save not less than $1000 a year.··· The routine work of caring for 1200–1500 laying hens takes about 3 or 4 hours of the time of an unskilled laborer employed at $20 to $25 per month with board. ·· I have been told of profits as high as $1.50 per hen for flocks of 400 to 500, but for the flocks of double those numbers and upwards the best estimates I can get from the farmers place average profits estimated on the per hen basis at about 80 cents (a head) above the cost of feed.

The Tillinghast Method

During the winter of 1907–1908 the writer was a member of a poultry class conducted by Professor C. K. Graham of Connecticut Agricultural College (now University of Connecticut). On the way to a poultry show at Hartford, Conn., the class stopped at the Tillinghast poultry farm. Gable-roof houses were scattered about a large pasture through which a brook ran. Once weekly, wheat screenings were carried by wagon, and a large bin hopper in each house was filled. The birds drank

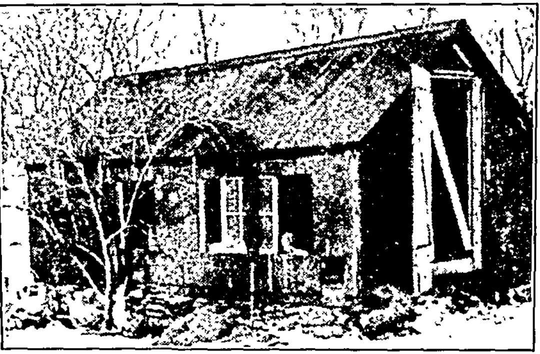

Fig. 1. A Tillinghast laying house at the Connecticut Agricultural College, 1909. (*Courtesy J. H. Robinson.*)

from the brook or ate snow or picked at ice. Eggs were gathered each evening. Perches were placed high above the ground floor, and houses were not cleaned until the droppings became numerous and so high that the birds roosted on them; or, it was said, when the point of necessity for doing something occurred the buildings were lifted or rolled over and placed on a new location. Production was not high, but neither were the costs of labor and feed. Figures on income and profits were not forthcoming. A Tillinghast house was used on the Connecticut Agricultural College poultry plant in the early years of the twentieth century.

Intensive Systems

Poultry were originally kept in small flocks in small houses. When these houses were several yards apart and the runs were spacious, the

plant was thought of as the extensive system. Later, the small units were brought together and finally built as long houses, with each pen and run separated from the others. The intensive system was thus born. From about 1860 until about 1920, when poultry plants were almost self-sufficient units in themselves and were producing eggs, maintaining breeding pens, and hatching chicks, these long, narrow houses and yards and small pens were common. The yards were boarded up for 2 feet or more to prevent male fighting. Investment in fence posts, lumber, and wire was considerable. In the early 1900's, for egg-production flocks in which males were absent, many plants had their inside fences removed leaving the outside fence only; this permitted 500 hens to run on ½ to 1 acre of land. Alternate yards were often provided. Pens in the house were maintained or made somewhat larger. Before 1910, long laying houses 20 feet wide were being constructed to hold 500 or more hens in one large pen with outdoor runs of ½ acre or more.

On such plants in 1910 and again in 1911 the writer was in charge of the breeder houses, consisting of small pens and long, narrow, boarded yards. Here was learned a fact written by John H. Robinson[2] who said in 1912: "Continuous poultry culture by intensive methods is practically impossible. The land becomes polluted by the excrement of the fowls and sometimes infected with disease germs, the stock deteriorates, and the poultryman cannot stand the stress and strain of working against natural laws."

Many intensive system plants or ranches, constructed on wealthy estates, later crumbled through disuse into decay. Currently they are found only rarely on commercial poultry plants. Small yards are rapidly disappearing. Confinement housing of layers and breeders and still later confinement rearing is being used extensively.

Breeds of Poultry

Writing in 1871, W. M. Lewis[3] states that the best breeds for egg production are the Poland and Leghorn, for the table, Dorking, and for early marketable chicken, Brahma and Cochin. A contemporary of Lewis states that for both meat and eggs a cross of Dorking cock on the Brahma hen is the "Farmer's Breed for Profit."

Currently the White Leghorn predominates for the production of white eggs, and Rhode Island Reds, New Hampshires, Plymouth Rocks, and crosses of Rocks and Reds or New Hampshires for the production of brown eggs. On the Pacific Coast a popular cross is Black Australorpe male and White Leghorn female. Crosses are used extensively through the Middle West. For broiler production, New Hampshires and the crosses appear to dominate in most intensive broiler sections.

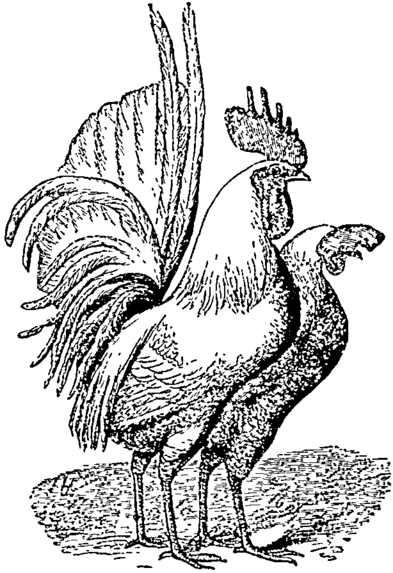

Fig. 2. Pair of White Leghorns about 1871 (*from* The People's Practical Poultry Book, *by W. M. Lewis*).

Evolution of the Laying House

The natural instinct of chickens to become domesticated, and their desire to come home to roost plus their insistence in spending the night at home regardless has given rise to many theories, much trial and error, and many practical attempts to build a home for them that would prove satisfactory to the fowl, as shown by high egg or meat production and good health.

To be sure, "poultry sense" has not always taken precedence over a bountiful supply of money, and many hen houses have been works of art but sadly deficient in the fundamental principles of good hen homes. From very early times in England, poultry and other livestock lived in

quarters adjacent to the human living quarters. Chickens roosted over the entrance doorway or in the gable end of the cottage near a warm chimney or elsewhere. Fair production under these conditions gave rise to the idea that warmth was helpful, and, when houses were constructed especially for fowl, they were made tight to conserve animal heat. A change of air was considered unimportant, and one poultryman in the United States stated many years ago, when questioned about ventilation, that "the only ventilation his birds needed was through the keyhole and he kept the key in that most of the time." *

The writer recalls, on his home farm in the early 1900's, a Bantam named Daisy, housed under such conditions. Although the house was

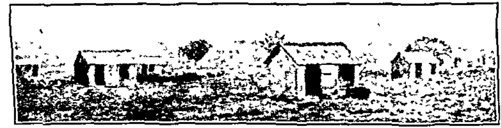

Fig. 3. Poultry farming in Rhode Island in the early part of the twentieth century. Colony laying houses were separated, four or five to the acre. Each house contained about 35 layers. (*Courtesy J. H. Robinson.*)

supposedly warm, the moisture content of the dead air was high, and Daisy, who lived to be 8 or 10 years of age in spite of the conditions, lost portions of both feet each winter by freezing until, at the close of her ill-fated and somewhat useless career, she was entirely without feet and walked on the stumps of her shanks.

Artificial heat was supplied early in houses for laying hens and usually discarded. However, the idea of its probable usefulness for layers still prevails, and it is occasionally employed, ordinarily with questionable results. Currently some use is being made of supplied heat to avoid the very low temperatures in laying houses without sacrificing a bountiful supply of fresh air.

Little was known of ventilation even in the early years of the twentieth century, and when it was attempted the ventilators were too small to show any beneficial results. During those years an open scratching shed fitted with a swinging front curtain of oiled canvas for inclement weather was located next to the tight, non-ventilated roosting room. When curtains were torn and glass windows were broken and remained unrepaired, it was seen that laying improved. The notion then spread that fowl

* Courtesy Professor J. C. Graham, formerly head of Department of Poultry Husbandry, Massachusetts Agricultural College, Amherst.

were fresh-air animals and would do better, with less expense, if more air were allowed. Fresh air, it was observed, was cheap and abundant. During or about 1909, Dr. Prince T. Woods designed the open-front, semi-monitor house, and Joseph Tolman the open-front combination-roof house. Tolman made use of the first open range shelter at that time, and the writer built and used one in 1912. The entire fronts of both open-type houses were wire covered and always open to the weather. The roosting room, as such, was eliminated. A roosting-closet curtain which could be lowered at night was retained in many houses but practically disappeared after 1915, when the Maine Agricultural Experiment Station found laying and health were better without it. During the 1930's ideas swung again to more tightly built houses, various methods of ventilating them, and the use of artificial heat for layers was discussed pro and con.

Ventilation ideas of various kinds have been advocated and tried. By 1950 well-insulated ceilings or roofs were regarded as necessary, deep houses appeared most useful for large flocks, with either rafter or slot ventilation at the front, with movable windows, or curtains, or both. An alternative that is fast taking hold in the Northeast is the electric fan method of moving the air, since it appears efficient and eliminates any trouble from snow or rain.

Laying Batteries

The first recorded use of batteries for hens and growing pullets is credited to Dr. D. C. Kennard who used them at Purdue University, 1918–1920, and later in the U.S.D.A., and in 1921 at the Ohio Experiment Station, Wooster. In 1927–1928 laying cages were coming into prominence. World War II upset cage manufacture because of the steel shortage. Popularity of cages may be related to the section of the country. On the Pacific Coast they are used extensively. In the East interest has diminished. In the East there may be a relation between general activity in industry and the use of cages. When people are out of work it has been observed they become interested in keeping poultry by the battery method.

The Brooder

Brooding has progressed from the hen and the capon, used from very early times for brooding chicks, to the small, individual, lamp-heated indoor and outdoor brooders, to the long, hot-water-pipe-heated brooder houses, to the colony gasoline-heated brooder for 250 chicks in an 8′ x 8′ house, to the various colony-house brooder stoves burning coal, oil, wood, gas, and later electricity for use in single buildings or long houses,

to battery brooders, and again to the long, pipe-heated permanent brooder.

About 1900 a post-card survey of many poultrymen in several states, by J. E. Rice, inquired how many chicks could be successfully brooded under one brooder. There were no replies indicating a number greater than 50.

The first published description of a pipe-brooder system appeared out of Elmira, N. Y., in 1884, issued by the Perfect Hatcher Company.

The intensive system for brooding chicks was used for several years before and after 1900. Long houses with narrow yards were common.

Fig. 4. Hen brooding near Little Compton, R. I., at the beginning of the twentieth century. Each coop housed one hen and her chicks. The hen was confined several weeks. The labor in feeding, watering, and otherwise caring for the chicks was high (*Courtesy J. H. Robinson.*)

Such brooder houses, used in advance of their time, came into disrepute because of unknown diseases and lack of nutritional information; after research unlocked these secrets they were to reappear. In 1910 the writer lost chicks which were running out in very limited, narrow brooder-house yards and in whose droppings blood was very evident. No doubt chicks had been weakened from malnutrition and had been dying of coccidiosis before. However, it still seems odd to the writer that the suggestion he received from an experiment station was that chicks would sometimes eat sharp pieces in the sand, which was then used on floors, and that the intestinal tract would be scratched by the sand and would exude blood. It seems more odd that poultrymen still lose chicks from the same causes and often do not know the reason nor the remedy.

The advent of the larger incubators led to a need for artificial brooding. The hen as a brooder on a commercial scale had to go. The long brooder house was in disrepute. The idea and the drawings for brooding 100 chicks in a gasoline-heated colony brooder were given to White and Rice of Yorktown, N. Y., by an acquaintance about 1900. Safety

changes were installed, and about 1903 the brooder was used by them for brooding 200 or more chicks in each colony house. Colony houses could be moved to new ground. Chicks were out early in direct sunlight and thrived. *Cornell Bulletin* 246, "The Cornell Gasoline-Heated Brooder," was published in May 1907, and this type of brooder became very popular until the price of gasoline became prohibitive.

Coal- and oil-burning brooders were developed in 1909 and 1913, respectively. Many variations of these were available for several years. The canopy-type colony brooder soon came along and is still being widely used.

Credit for the first battery brooder goes to Charles A. Cyphers in 1905. This was the shelf type. Cyphers had a good idea, but he was ahead of his time. It failed, not because the brooder was impractical, but because nutritionists had not caught up with the designers of mechanical equipment. Lack of vitamins caused severe losses, and the long brooder house and the battery brooder were abandoned temporarily. The battery brooder came into use commercially again, but, until 8 or 9 years after World War I, its development was at a standstill. It has been in successful use for several years for starting chicks one to two weeks before moving to colony brooders. Battery brooders serve a useful purpose in hatcheries where chicks may need to be held for a few days before being sold.

Currently and for several years past there is a very noticeable trend toward the long, permanent brooder house, as previously mentioned. The houses are heated by various means. They vary from single to several stories. Battery and colony brooders have little use under this system of brooding.

See Chapter 7 for other economical uses of the permanent brooder house.

Incubation

A writer [4] a century ago refers to the ancient incubation methods used in China and Egypt, but doubts that the plan will ever become general or produce a supply of apparatus-hatched chickens sufficient to be in constant readiness to meet public demand. Let us be content then, he writes, "with our poultry yards and their feathered inmates as they are."

Machines did exist then, however. The eccaleobion for hatching chicks was 9′ x 3′ x 3′. The polotokian was used for hatching by means of heated air in 1843 and was established by E. Bayer of Brooklyn, N. Y., but was found unprofitable on Long Island, N. Y., and was abandoned.

The first reference * to commercial hatchery operations is in 1873. At that time Jacob Graves, Boston, invented and patented an incubator and offered for sale 2–4-weeks-old chicks. This became the first recorded case of artificially hatched chicks offered for sale commercially. Small incubators were manufactured and advertised in the 1880's and had been used for many years by the beginning of the twentieth century. In 1907 the writer bought his first incubator and, thereby, graduated from the hen method of hatching. This 75-egg machine was filled with eggs from his father's run-of-barnyard fowl and set in the living room. Intense interest and lack of information proved the death of the 13 chicks that hatched. The writer spent the night on the living-room couch, and the peep of a chick was his signal to remove the wet chick from the incubator to a felt-lined grape basket. Later, saner methods proved more successful, and the marketing of future roasters helped defray expenses at Connecticut Agricultural College that fall. The later hatches were brooded in a small kerosene-lamp brooder in the kitchen where the fumes, mingled with those of other kerosene lamps, were less objectionable than might be the case today.

Mammoth incubators of the long type entered the picture toward the end of the century and early in 1900. C. A. Cyphers, in 1896, is credited with building a 20,000-capacity incubator. The Hall mammoth was on the market in 1908. This was a long, pipe-heated, multi-apartment machine. The cabinet-type incubator, forced draft, was patented about 1918 and marketed commercially about 1922 by Dr. S. B. Smith. Rights on smaller sizes of the cabinet type were leased to the Buckeye Incubator Company, Springfield, Ohio.

Credit is given to Ira M. Petersime for making the first electrically heated mammoth incubator in 1923. Since then many cabinet-type, electrically operated incubators have been placed on the market and successfully used.

Chick Shipments

In 1892 the first express shipments of chicks was made by Joseph D. Wilson, Stockton, N. J. In 1907 the corrugated chick boxes were introduced. Chicks were sent by mail parcel post in 1918, and in 1930 airplane shipments to Central America began. Chicks are now shipped from coast to coast in the United States and to other countries.

* The writer is indebted to Art Hirsch in whose article, "Growth of Hatchery Industry—A Story of American Perseverance and Vision" (*Poultry Supply Dealer*, January 1948), several names and dates appear under the heading "Incubation and Chick Shipments."

Feeding

For the development of this important phase of poultry management, the reader is referred to Chapter 1 of *Poultry Feeding*, by G. F. Heuser (John Wiley & Sons, New York, 1946).

Poultry Disease

As the poultry industry grew and poultry population increased, diseases and parasites multiplied. Losses from what was then called white diarrhea were becoming of major importance early in 1900.

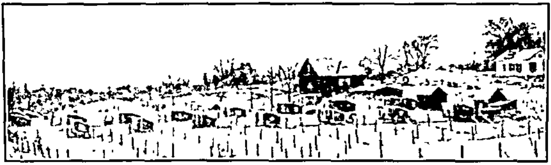

Fig. 5. The poultry plant at Connecticut Agricultural College (University of Connecticut), 1909. (1) Barn in which fowl were prepared for Dr. Rettger's pullorum-disease experiment; (2) brooder house for chicks in the pullorum-disease experiment; (3) incubator cellar and poultryman's quarters; (4) the Tillinghast laying house; (5) a scratching-shed laying house.

Dr. Leo. F. Rettger of Yale University in 1899 had isolated the germ thought to be responsible. Dr. Rettger and Professor F. A. Stoneburn of Connecticut Agricultural College decided to work on the problem. The writer was poultryman on the Connecticut Agricultural College poultry plant during the summer, fall, and winter of 1909, and he brooded the chicks and prepared the original group of 29 or 30 fowl for bacteriological examination by Dr. Rettger. That year the disease was named bacillary white diarrhea (B.W.D.). By 1910 the organism was found to be located in the ovaries, whence it was transmitted through the egg to the resulting chick. Work proceeded rapidly and, in 1913, Dr. F. S. Jones of the New York State Veterinary College found that hens having the disease can be discovered by the tube agglutination test; he used this method in 1913. Eastern poultrymen began using the method through official state pullorum-testing work in 1918. Currently many states work in cooperation with the National Poultry Improvement Plan, which includes the pullorum-control stage. The *disease, now called pullorum disease, is entirely eliminated in many* breeding flocks. Variations of blood testing have been developed until

there seems to be no excuse for further trouble. All that is necessary for control is cooperation with existing agencies.

Vaccines were developed in 1926 for fowl pox, in 1932 for laryngotracheitis, and still later for Newcastle. Bronchitis immunization was employed first in the New England States, and its use is spreading westward.

The avian leukosis complex is widespread. Although research on this disease was reported by several workers and countries at the World's Poultry Congress in Ottawa, Canada, in 1927, it still remains one of the most important economically of the poultry diseases and one of the most baffling to disease research workers.

Marketing

The reader is referred to *Marketing Poultry Products* by Benjamin, Pierce, and Termohlen (John Wiley & Sons, New York, 1949).

Culling and Selection

The reader is referred to *Judging Poultry for Production*, by Rice, Hall, and Marble (1930), and to *Poultry Breeding*, by Jull (2nd edition, 1952) (both published by John Wiley & Sons, New York).

Education and Instruction

In 1891–1892 a course in poultry husbandry was initiated at Cornell University by James E. Rice and given to 50 regular, special, and winter-course students. The course consisted of 10 lectures. From 1893 to 1903 Rice gave lectures on poultry husbandry at institutes held throughout New York State.

At Rhode Island State College in 1898 a short course in poultry culture was given by Professor A. A. Brigham. At Connecticut Agricultural College in 1901 the first college department of poultry husbandry in the United States was established with Professor F. H. Stoneburn as head. In 1903 a poultry department was organized as part of the Animal Husbandry Department, and systematic instruction to students at Cornell University began. Rice was in charge and, in the same year, was appointed assistant professor. In 1907 the Cornell University Department of Poultry Husbandry was established as a separate department, and Rice was appointed professor and head of the department. Here, also, in 1912 the first poultry administration building was constructed. Other names prominent in early and later development of poultry husbandry are James Dryden, Horace Atwood, G. M. Gowell, and W. R. Graham

From these early beginnings college and university instruction has spread to practically every state.

The Poultry Science Association was organized in 1908 at Cornell University and holds annual meetings throughout the United States and Canada.

The World's Poultry Science Association was organized at London, England, in 1912. This organization acts as the international representative for the poultry industry. The *World's Poultry Science Journal* is issued quarterly by the association and made available to members. Meetings are held each third year, at the time of the World's Poultry Congress, the only exception being the war years. The association sponsors the congress. Both are international in scope.

The places of meeting for the association and the congress, and the years, have been as follows: The Hague, Holland, 1921; Barcelona, Spain, 1924; Ottawa, Canada, 1927; London, England, 1930; Rome, Italy, 1933; Leipsig, Germany, 1936; Cleveland, Ohio, U.S.A., 1939; Copenhagen, Denmark, 1948; Paris, France, 1951.

Economics of Poultry Management 100 Years Ago

The principles of poultry management existed at least 100 years ago. D. J. Brown[4] stated in 1851: "The more densely poultry are congregated, the less profitable will they be, the more thickly they are crowded, the less they will thrive." The violation of this rule has caused great loss among poultry flocks, and its truth and resulting losses from its violation still prevail. Improvements today are results of our knowledge of and the means of combating certain diseases, the advance in culling and breeder selection, facts then unknown about nutrition, and more sound information on the principles of poultry management.

Egg records were kept at least as early as 1844. Gerard Carpenter, Poughkeepsie, N. Y., started January 1, 1844, with 67 hens and 3 cocks. Seven hens were sold and lost to May 1 and two hens from then to September 16. The average number during the year was estimated as 60. The egg production was: January, 191; February, 400; March, 892; April, 1037; May, 1086; June, 700; July, 838; August, 740; September, 540; October, 113; November, 21; December, none; Total, 6558.

In addition, probably "300 eggs were used for sitting, got lost, broken or spoiled" and are not included. The food was as much Indian corn mixed with a few oats as they could eat. Grain was placed where they could get it whenever they felt inclined. In the winter a little meat was given. The birds were not confined. While the ground was covered with snow there was access to lime and gravel.[4]

The same book [4] shows the account of Mr. Edwin Howard of Easton, Mass., taken from the *Boston Cultivator*, December 22, 1849:

Dec. 1, 1848. 19 hens, 1 rooster. Val. $20 00. In the spring 1 hen added.
The account:

Eggs sold, 1300	$27.97
Eggs not sold, 581 @ 15¢ per doz.	7.27
Fowls sold	46.48
Val. of fowls on hand over last year at this time	10.00
	91.72
32½ bu. corn and meal @ 75¢	24.37
Balance in favor of fowls	$67.35

The Egg Business in 1848

Sales in and around the Quincy market for 1848: 1,129,735 doz.
Value at 18¢ per doz.: $203,352.30. (Lowest price 11½¢, highest 30¢.)
Sales for entire city of Boston for 1848 was over $1 million.
Cincinnati, Ohio, in one day, according to public journals, shipped 500 bbl. of eggs (47,000 doz.).
A Philadelphia dealer shipped to the New York market daily nearly 100 bbl.
New York City expends nearly $1½ million annually in the purchase of eggs.[4]

Chickens on Farms, 1840–1950

According to agricultural statistics of 1840, the value of poultry in the State of New York was $2,373,029, Pennsylvania stood second with a value of $1,033,172, Alabama was third with $829,220, Virginia fourth with $752,467, and Ohio fifth with $734,931.[4]

Chickens on farms,* Jan. 1, 1940, in the United States totaled 429,042,000 and were valued at an average figure of $0.604 each or a total of more than $259,000,000 The states leading in numbers of chickens in 1940 were:[5] Iowa, 30,930,000; Texas, 25,871,000; Illinois, 22,953,000; Missouri, 22,027,000; Ohio, 21,548,000 On January 1, 1950, three of these same states were among the leading five in point of numbers: Iowa, Texas, and Missouri. Minnesota and Pennsylvania replaced Illinois and Ohio The number of chickens in the five leading states increased by several million each.

The number of chickens in all states increased, 1950 over 1949, except two (South Carolina and Louisiana). The total net increase in the United States, 1950 over 1949, was 32,514,000 chickens. The high value of chickens in the East and West Coast states placed California and

* Does not include commercial broilers

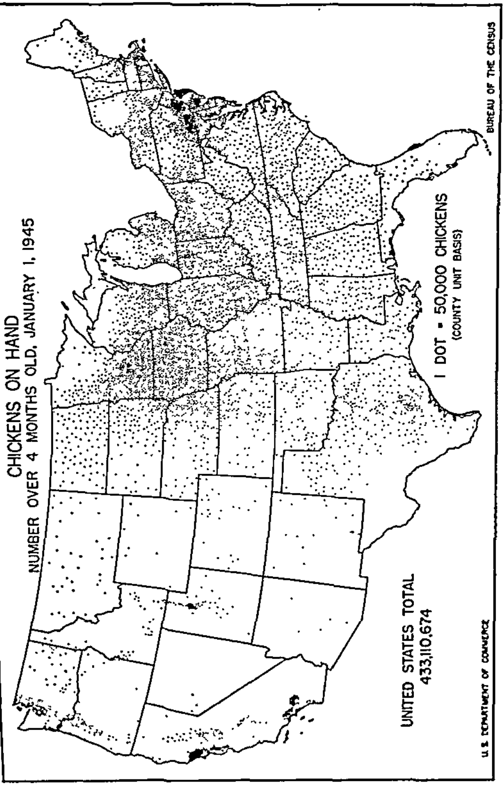
CHICKENS ON HAND
NUMBER OVER 4 MONTHS OLD, JANUARY 1, 1945
1 DOT = 50,000 CHICKENS
(COUNTY UNIT BASIS)
UNITED STATES TOTAL
433,110,674
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Fig. 6.

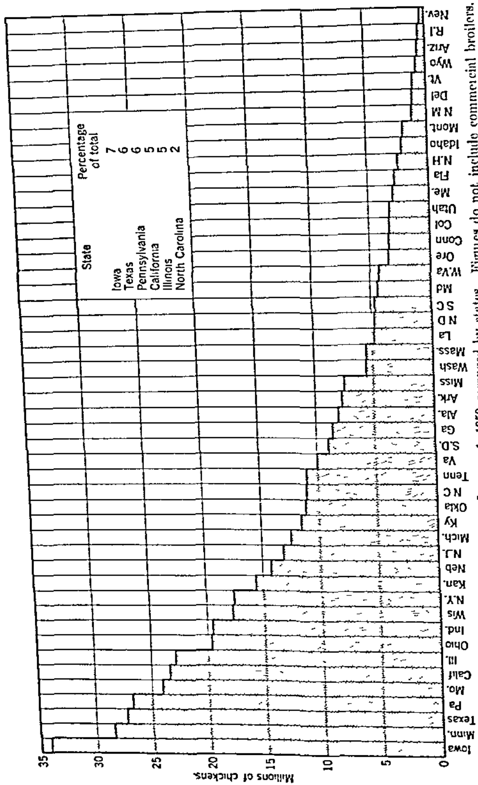

FIG. 7. Chickens on farms in the United States, January 1, 1950, arranged by states. Figures do not include commercial broilers. Total for the United States: 181,190,000. (*Source: U S D.A. Agr. Statistics*, 1950.)

New York among the first five states in total value of chickens.[5] For 1950 the number and value of chickens for the five leading states is shown in Table 1.

Table 1

Number		Value	
Iowa	34,258,000	Iowa	\$46,933,000
Minnesota	28,471,000	Pennsylvania	44,013,000
Texas	27,384,000	Minnesota	37,866,000
Pennsylvania	26,837,000	California	35,124,000
Missouri	24,124,000	New York	33,565,000

Comparing 1950 with the 1939–1948 average in the United States, we find that the value of chickens had increased nearly 28 per cent but that the number had decreased by more than 5 million. Number of chickens decreased in 33 states and in all regions but the North Atlantic and Western. The greatest drop occurred in the South Central states and the largest increase in the North Atlantic states.

On January 1, 1950, chickens on farms totaled 481,190,000 and were valued at an average of \$1.36 each, or a total value of \$655,210,000. The number, by regions, is shown in Table 2.[5]

Table 2

	Average 1939–1948	1950
North Atlantic	62,586,000	73,855,000
East North Central	93,910,000	92,804,000
West North Central	135,977,000	130,736,000
South Atlantic	49,775,000	47,296,000
South Central	101,460,000	89,806,000
Western	42,650,000	46,693,000
United States	486,359,000	481,190,000

Size of Flocks on United States Farms in 1940

Chickens are found on a large number of the farms in the United States. In 1940, 94.3 per cent of the farms reporting chickens 4 months old or older had flocks of 200 or fewer. Nearly one-third of the total number of farms had 25 chickens or fewer per farm. On 99.782 per cent of the farms were found 1000 or fewer chickens, and flocks of 1000–2500 chickens were on 0.182 per cent of the farms, whereas the largest flocks having 2500 or more chickens were found on only 0.036 per cent of the farms.[6]

The trend in the number and percentage of farms reporting chickens is downward. It is possible in certain sections, where larger flocks are

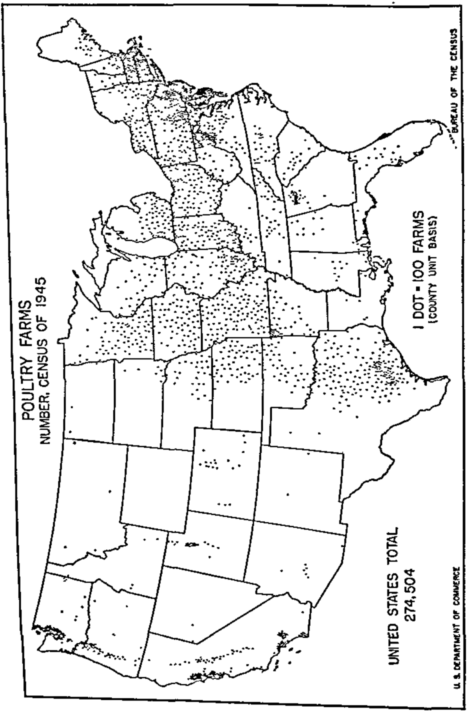
POULTRY FARMS
NUMBER, CENSUS OF 1945
1 DOT = 100 FARMS
(COUNTY UNIT BASIS)
UNITED STATES TOTAL
274,504
U. S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Fig. 8(*a*).

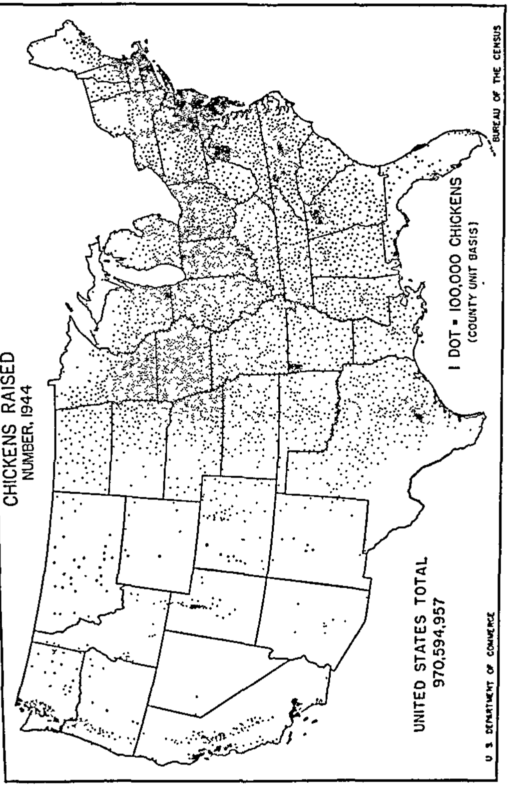
CHICKENS RAISED
NUMBER, 1944
1 DOT = 100,000 CHICKENS
(COUNTY UNIT BASIS)
UNITED STATES TOTAL
970,594,957
U S DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Fig. 8(*b*)

increasing in number, that small flocks on many farms are disappearing (Table 3).

Table 3. Number and Percentage of Farms in the United States Reporting Chickens [6]

Year	*Farms*	*Percentage*
1910	5,578,425	87.7
1920	5,837,367	90.5
1925	5,505,617	86.4
1930	5,372,597	85.4
1935	5,833,079	85.6
1940	5,150,055	84.5
1945 [7]	4,896,374	83.6

For 1910, 1930, 1935, chickens over 3 months old reported.
For 1920, 1925, age not specified.
For 1940, chickens over 4 months old reported.

Importance of Specialized Poultry Farms in 1945

Poultry farms on the basis outlined below* comprised 4.7 per cent of all farms. Their average size was 69.6 acres. However, more than one-quarter of all poultry farms had fewer than 10 acres each.

The value of land and buildings per poultry farm averages $5357. Only 1 out of 8 is capitalized at more than $10,000.

Poultry farms contribute 5.4 per cent of the value of all farm products sold and 48.3 per cent of the value of all poultry and poultry products. These farms have 18.6 per cent of all chickens and produce 24.1 per cent or nearly one-quarter of all eggs.

About 86 out of every 100 specialized poultry farms are operated by the owners, and almost half of all operators of such farms are 55 years old or older.

Nearly half of these farms have running water and mechanical refrigeration; 2 out of 3 have electricity; 1 out of 4 has a motor truck; and 2 out of 3 have cattle.

REFERENCES

1. Robinson, J. H., *Poultry Craft*, p. 7, Farm Publishing Co., Boston, Mass., 1904.
2. Robinson, J. H , *Principles and Practices of Poultry Culture*, pp. 90–91, Ginn and Co , New York, 1912.

* From the 1945 Census of the United States. If the value of the products sold from one source of income was more than 50 per cent of the total value of all farm products sold, the farm was classified as the type corresponding to that source of income

3. Lewis, W. M., *The People's Practical Poultry Book*, D. D. T. Moore, Rural New Yorker, New York, 1871.
4. Brown, D. J., *The American Poultry Yard*, C. M. Saxton, New York, 1851.
5. U.S.D.A. *Agr. Statistics*, 1950.
6. U. S. Dept. Commerce Census Bur., *16th Census of the United States*, 1940, Special Poultry Report.
7. U. S. Census of Agriculture, Dept. of Commerce, Bur. of the Census, 1945.

2 · Financial Opportunities in Poultry Husbandry

Engaging in practical poultry husbandry is a gamble.
The chances for loss or of gain are considerable.
Labor incomes by years vary enormously.
Labor incomes in any one year vary greatly between farms.
The opportunity has been present in recent years for making good hourly wages in practical poultry husbandry.
*The purchasing power * of these wages has been generally favorable.*

Poultry husbandry as a business is a fine example of the biblical expression, "To him that hath shall be given, but to him that hath not shall be taken away even that he hath." That is, the poultryman who is trained in the science and the art of poultry husbandry, who has both business judgment and poultry sense, and who has the ability and incentive to work, may expect desirable rewards, but to him who "hath not," the expected, although disappointing, penalties are certain and the poultryman is likely soon to be forced out of business.

Financially, poultry husbandry is a gamble in the sense that, once the investment is made, the chances of success or failure depend not only on the individual characteristics mentioned above but also on economic conditions beyond the investor's control, such as the general price level, feed prices, and the general prices prevailing for eggs.

The poultry enterprise, in its various aspects, like any other business, varies enormously in its possibilities for profit. In what are considered good years some poultrymen have lost financially or have made disappointing returns. In poor years, measured by the general level of prices, some poultrymen have done well with poultry.

Profit and labor incomes vary by years and operators. They are not static but are subject to many widely different influences, as is shown in Table 4, based on more than a thousand records taken by the New York State College of Agriculture from commercial poultrymen up to and including 1941.

* See page 57.

Table 4

Year	*Number of Poultry Farm Records*	*Average Labor Income*
1926	153	$1840
1929	148	2250
1930	123	1590
1931	126	720
1932	119	320
1933	136	550
1934–1940	148	1320
1941	120	1600

Profit or loss is the amount left after all costs (estimated or actual and including the value of all paid or unpaid labor) are deducted from all returns. It is what the operator has for his ability or skill as a manager or owner, or both. He has already been paid a salary for time he spent on the enterprise.

Labor income is one of the best measures of the efficiency of a farm business. It may be defined as what a farmer receives for his year's work in addition to a house in which to live and farm products to use, after paying all farm business expenses, and after deducting a charge for the use of the capital invested. It will be seen that in addition to his labor income the farmer receives the use of a dwelling and the eggs, meat, garden, and other products grown on the farm. Should it be desired to compare the labor income with city salaries, the value of the house rent and the products used must be added to the labor income.

Labor income is found on the complete farm enterprise; profit or loss can be found on a business of any size, whether full or part-time. Therefore, in using labor income as a measure of poultry businesses in different sections or in comparison with other agricultural enterprises, farms specializing in poultry should be chosen. If the flocks are small, labor income may be called poultry labor income, the difference being that the results refer only to the poultry enterprise.

Table 4 shows the *variation by years* for labor incomes on 1073 New York State poultry farms[1] from 1926 to 1941. The average for the entire period was $1300.

Wide differences occur in labor incomes. In Massachusetts[2] in 1942 on 33 farms the labor income was $2095: on 11 high-income farms it was $3880, but on 11 low-income farms it was $723. In 1944 on 21 farms labor income was $1971: on 8 high-income farms it was $4015, but on 8 low-income farms it was $88.

A "business analysis of 114 poultry farms in eastern Massachusetts,

1937," by Charles R. Creek, showed that on 34 retail farms more than two-thirds of the sales were of market eggs with little source of other income; 1200 layers housed returned $681 in labor income. On 71 wholesale farms were sold a higher proportion of broilers, fowl, and chicks; a labor income of $1130 was returned from 1587 layers housed. Breeding farms sold twice as many chicks as market eggs along with broilers, fowl, and hatching eggs. Although the breeding farms averaged more hens, a point to consider is that good prices were received for low-priced eggs by transforming them into chicks. On 9 breeding farms with 2608 birds housed, a labor income of $2336 was realized. Size of flock may have had an important influence on size of labor income. However, the labor income per bird housed in this group of farms was $0.57, $0.71, and $0.90, respectively.

From 1941 to 1948 labor incomes were favorable in many sections. A few examples are shown in Table 5. A rising price level and the leavening effect of number of both birds and farms appear influential.

Table 5

Year	*State or Province*	*Number of Farms*	*Variety*	*Average Number of Birds*	*Labor Income*
1941	Iowa [4]	22	—	207	$ 679
1941	Kansas [5]	38	General purpose	154	282
1941	Kansas [5]	33	Egg breeds	335	525
1945	British Columbia [6]	46	—	656	1001
1946	Washington [7]	41	—	709	1716
1948	Indiana [8]	71	—	356	719
1948	Washington [9]	51	—	815	2103

Variations in Labor Incomes Occur in Any Year

Not only do labor incomes vary from year to year, because of general price fluctuations, but within any one year poultrymen's incomes vary from farm to farm.

Dr. L. B. Darrah, in his *Cornell Extension Bulletin* 713, "Make Your Poultry Farm Pay," published in April 1947, shows a tabulation of labor incomes for the three years 1929, 1932, 1941. The range in any year is wide. These results are duplicated wherever poultry husbandry is practiced.

Returns per man-hour spent on a laying flock provides a means of measuring financial opportunities, in any given year, since it is a figure to compare with hourly rates elsewhere. A poultry plant will continue to return a favorable hourly rate only when efficiency in costs, returns, and man-hours per bird prevail. It is, therefore, with poultry, a measure of labor and management efficiency.

To find the return per man-hour, apply these formulas:

$$(1)\qquad \frac{\text{Gain or loss} + \text{cost of labor}}{\text{Man-hours}} = \text{Return per man-hour}$$

$$(2)\qquad \frac{\text{Total returns} - (\text{Total costs} - \text{All labor})\,^*}{\text{Man-hours}} = \text{Return per man-hour}$$

Apply either formula to Table 6, which shows the average gain per bird on 14 poultry ranches, Los Angeles County, Calif., for 1948. The ranches averaged 921 hens, 2.6 man-hours per hen. The return per man-hour is $1.25.

Table 6. Average Income, Expense, and Gain per Bird, 14 Los Angeles, California, Poultry Ranches, 1948

Income per hen	
Egg sales	$10.02
Poultry sales	1.74
Miscellaneous	0.26
Inventory increase	0.60 [a]
Total income	$12.62
Expenses per hen	
Feed costs	
Mash	$ 6.32
Grain	0.94
Other	0.10
Total feed	$ 7.36
Chick purchases	0.78
Hired labor	0 30
Family and operator's labor	1.64
Miscellaneous	0.51
Depreciation	0.29
Interest	0.39
Inventory decrease	0.00
Total expense	$11.30
Gain	1.32

[a] Inventory increase may include equipment and supplies on hand, which were purchased during the year, such as feed and miscellaneous items, and which appear under "Expenses."

Financial opportunities in poultry husbandry exist over widespread areas. Periods of rising or high egg prices have followed the general

* Paid or unpaid.

price level and have influenced returns. For several years and currently both prices and returns per man-hour have been favorable.

In terms of 5-year periods, returns per man-hour from poultry on New York State cost-account farms have compared favorably with the returns for dairy cows and sheep. Cost-account records * in New York State for more than 20 years show that poultrymen are increasing size

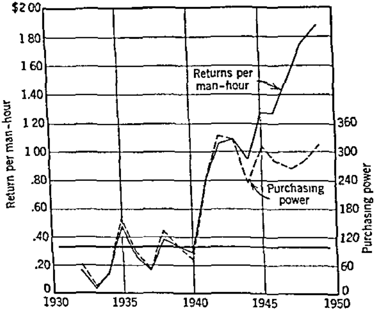

FIG 9 Returns per man-hour from 604 New York State poultry cost-accounts, 1932–1949, and purchasing power in terms of the all-commodity index, 1935–1939 base. Since 1941 the purchasing power of returns per hour on eastern poultry farms has remained about the same and relatively high.

of flocks, getting better average *production*, making larger gains financially, and enjoying better hourly wages. This is being accomplished with fewer hours of work, secured without strikes or inconvenience to others. The year 1941 seems to have been a turning point for better results with poultry. The farm price of eggs was rising rapidly along with the decided upward trend in the general price level (Fig. 18).

Hawthorne in Pennsylvania reports on 32 flocks averaging 755 hens, in 1946–1947. The return per man-hour was $1.48.

Reports for 3 years on North Central Indiana farms show the return per man-hour to be higher for the total poultry enterprise than for the laying flock alone In 1938–1939, 38 farms reported an average return per man-hour of $0 546 for the total poultry enterprise and of $0.501 for the laying flock; in 1939–1940, 72 farms reported $0.344 for the

* Department of Agricultural Economics, Cornell University.

total enterprise and $0.247 for the laying flock; and in 1940–1941, 81 farms reported $0.523 for the total enterprise and $0.444 for the laying flock.

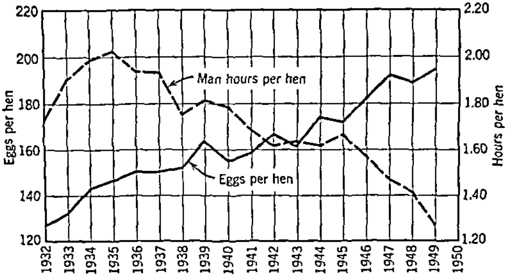

Fig. 10. Eggs per hen and man-hours per hen, from 601 New York State poultry cost-account records, 1932–1949. Eggs per hen increased on New York State cost-account farms during these years. The number of hens has also increased, resulting in greater efficiency in use of labor.

Year	*Number of Farms*	*Average Number of Hens per Farm*	*Eggs per Hen*	*Hours per Hen*	*Returns per Man-Hour*	*Gain or Loss, Weighted by Number of Hens*
1949	22	1379	194	1.26	$1.87	$1705
1948	23	1090	188	1.41	1.75	1395
1947	23	1082	191	1.47	1.52	1173
1946	23	910	181	1.57	1.27	801
1945	28	899	172	1.66	1.27	996
1944	33	936	174	1.61	0.93	505
1943	35	921	161	1.63	1.29	1184
1942	36	935	166	1.62	1.25	1288
1941	32	935	158	1.68	0.79	703
1940	43	761	155	1.78	0.24	−100
1939	39	762	164	1.81	0.27	−65
1938	39	737	152	1.75	0.39	98
1937	46	720	150	1.93	0.17	−201
1936	45	716	150	1.94	0.26	−59
1935	41	760	146	2.03	0.48	276
1934	38	755	143	1.98	0.13	−219
1933	29	742	133	1.90	0.03	−350
1932	29	781	127	1.73	0.17	−174
1927–1930	—	503	133	1.81	0.53	102

Seventeen cost-account farms in Illinois,[13] carrying from 43 to 262 hens, showed poultry to be of minor importance. The flocks appear to be too small to handle economically. The work, in the main, is done by the farmer's wife and children. In 1947, only two farms showed a profit,

the net returns per 100 hens being $144.88 and $22.06. The average return per man-hour spent on poultry on these two farms was $1.47 compared to only $0.08 for the average of the 17 farms.

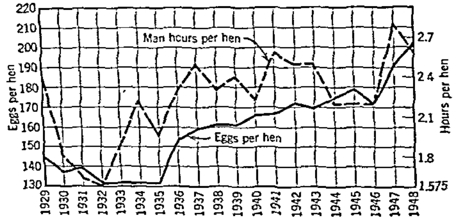

FIG. 11. Eggs per hen and man-hours per hen from 420 cost-account records, 1929–1948, California. Eggs per hen have increased since 1935 on Los Angeles County cost-account farms. Size of flock has remained fairly constant. Man-hours per hen have varied slightly.

Year	*Number of Farms*	*Average Number of Birds per Farm*	*Eggs per Hen*	*Man-Hours per Bird*	*Returns per Man-Hour*	*Gain or Loss, Weighted by Number of Birds*
1948	14	921	202	2.6	$1.25	$1215.72
1947	15	1097	190	2.8	1.18	1360.28
1946	10	1466	172	2.2	0.81	161.26
1945	17	1503	179	2.2	1.49	2494.98
1944	20	1371	175	2.2	0.85	383.88
1943	25	1441	169	2.5	1.25	2723.49
1942	34	1457	172	2.5	0.90	1631.84
1941	39	1341	167	2.6	0.59	1019.16
1940	39	1466	166	2.2	0.36	219.90
1939	33	1311	161	2.4	0.53	747.27
1938	36	1137	161	2.3	0.53	613.98
1937	18	1279	159	2.5	0.39	319.75
1936	10	1129	153	2.3	0.60	824.17
1935	16	1532	132	2.0	0.43	444.28
1934	11	1178	132	2.2	0.14	−459.42
1933	18	1405	132	1.9	0.05	−674.40
1932	18	2064	131	1.3	0.16	−722.40
1931	16	1650	139	1.6	0.15	−825.00
1930	17	1584	137	1.8	0.65	586.08
1929	14	1364	145	2.4	0.80	1336.72

The Agricultural Extension Service of Los Angeles, Calif., has analyzed the accounts of cooperating poultry keepers in Los Angeles County. Average size of flock and man-hours per bird have been fairly constant but show an increase in eggs per hen, returns per man-hour, and profit. The year 1941 appears to have been a turning point finan-

cially in the West as in the East. Results covering 1929 to 1948, inclusive, from poultry cost accounts in Los Angeles County, Calif., are shown in Fig. 11.[14]

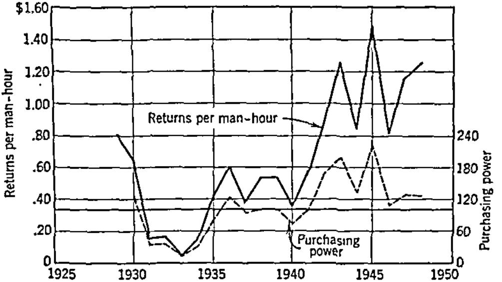

Fig. 12. *Returns per man-hour from 406 Los Angeles County, Calif., poultry cost* accounts, 1929–1948, and purchasing power in terms of the all-commodity index, 1935–1939 base. In general, the purchasing power of poultrymen's returns in Los Angeles County has improved since 1934. Ability to buy, starting in 1946, was less favorable than in several years preceding and nearly down to the 1935–1939 base, although returns were higher.

Four important factors influencing profits were shown in California by separating 225 records into two groups, high and low profits, and then averaging each group (Table 7). The high group had more hens and higher production, accomplished the work in less time, and produced eggs at $0.10 less per dozen.[1]

Table 7

	High-Profit Groups	*Low-Profit Groups*
Number of records	112	113
Average number of hens	1688	985
Eggs per hen	175	156
Man-hours per hen	2.1	2.8
Cost per dozen eggs	$0.252	$0.35

In Alameda County, Calif., from 1941 to 1948, the man-hours per hen were more than 2. The return per man-hour generally improved as economic conditions improved (Table 8).[15]

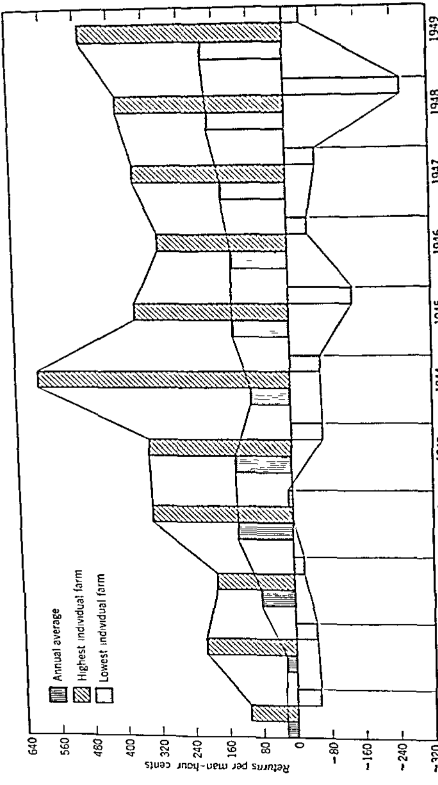
Annual average
Highest individual farm
Lowest individual farm
Returns per man-hour cents
640
560
480
400
320
240
160
80
0
−80
−160
−240
−320
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949

Fig. 13. Range in returns per man-hour, 332 New York State cost-account poultry farms, 1933–1949. The average returns per man-hour show an upward trend. Variations among individual farms in any year are enormous. (*From individual factors and annual averages from cost-account records, Dept. Agr. Econ., Cornell Univ.*)

Year	*Number of Farms*	*Average Returns per Man-Hour*	*Range in Returns per Man-Hour*	
			Highest	*Lowest*
1933	29	\$0.03	\$0.47	\$−0.76
1934	38	0.13	1.24	−0.75
1935	44	0.48	1.40	−0.07
1936	45	0.26	1.39	−0.78
1937	46	0.17	1.19	−0.89
1938	39	0.39	1.78	−1.71
1939	39	0.27	1.14	−0.54
1940	43	0.24	2.07	−0.52
1941	32	0.79	1.79	−0.27
1942	36	1.25	3.22	+0.07
1943	35	1.29	3.26	−0.78
1944	33	0.89	5.88	−0.76
1945	23	1.27	3.57	−1.49
1946	23	1.27	2.95	−0.48
1947	23	1.52	3.52	−0.66
1948	23	1.75	3.90	−2.63
1949	22	1.87	4.77	−0.32

Table 8

Year	Number of Farms	Average Number of Man-Hours per Hen	Average Return per Man-Hour
1941–1942	10	2.0	1.17
1942–1943	12	2.3	1.35
1943–1944	18	2.3	0.97
1944–1945	17	2.1	1.50
1945–1946	15	1.9	1.30
1946–1947	18	2.0	1.70
1947–1948	16	2.1	1.85

In San Bernardino County, Calif., for 1947,[16] 14 farms had returns per man-hour of $1.86, and on 19 farms in 1948,[17] $1.87.

Opportunities appear to exist in Hawaii. In 1947, 6 poultrymen kept enterprise-efficiency records. The return per man-hour varied from $2.76 to a loss of $0.05. The average of all 6 was $1.70. The two egg producers averaged $1.91, which was above that received by two broiler and two chick producers.

Variations in Returns per Man-Hour Occur in Any Year

Averages covering a group of farms do not always tell the possibilities that prevail for gain or loss in the individual poultry enterprise. Regardless of the price trends and in spite of low prices for eggs, high prices for feed, and the like, certain poultrymen succeed financially, whereas others do not. See Fig. 13.

Indiana workers have shown this annual variation among individual farms in a different but no less startling manner[8,12] (Table 9).

Table 9

Class According to Return per Man-Hour	Flocks in Each Class 1941–1942	1945–1946
$2.00 and over	2	4
1.00 to 1 99	9	7
0.50 to 0 99	8	25
0.00 to 0 49	23	33
0 01 to −0.49	6	22
−0 50 to −0.99	—	7
−1.00 to −1 49	—	2
Total number of farms	48	100

For 1948, on 39 Iowa farms averaging 281 hens, Whitfield[19] found an average return per man-hour of $1.94, whereas on the 10 high-labor-

income flocks the figure was $3.50 and on the 10 low-labor-income flocks $0.44. The author states that the results "show great possibilities not being realized by a considerable portion of our cooperators."

The chance of success or failure in the poultry enterprise rests to a great extent with the individual, his knowledge, his ability to visualize possibilities year by year and chart his course accordingly, his ability to think, his incentive to carry his thoughts into action, and his all-around judgment in handling poultry and the products he intends to sell. The wide range that exists in the return per hour suggests that neither the general price level nor the price of eggs reacts the same with every poultryman. Other factors are vitally important.

What are the causes of these wide differences? How can the poultryman organize his enterprise, in view of the many factors existing, to avoid falling into the minus profit group and to find a place in as high a net-income bracket as the size of his business and other conditions warrant?

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3 · Benefits and Limitations of Poultry Husbandry

1. The demand for poultry and eggs as human food is the great stabilizing factor for the permanency and profit of poultry husbandry as an occupation.

The egg, delicious to the taste, high in nutrients, of great importance in human diet, and supported in its own individual mineral container in a size convenient for use, has established itself as a necessity and a universally used food. Eggs are a standard ingredient of many recipes and are in high favor in the United States and Canada as a favorite breakfast main dish. Eggs are highly digestible; high in nutritive value; safe from danger of infection; ordinarily economical compared to other foods on a pound basis; may be cooked in a large number of ways; are convenient to use; are capable of long-time holding by storage, at home or commercially, by proper temperature and humidity control, and by thermostabilization, freezing, or drying. The large number of varieties of poultry, including ducks, geese, turkeys, pigeons, guineas, and the domestic fowl, each with its own attractive and special flavor, provides an array of animal food suited to every taste.

2. The efficiency of poultry as productive units is indicated by

Quick growth. The Chicken of Tomorrow contest in Connecticut for 1948 resulted in birds weighing 3.54 pounds at 12 weeks, or 1 pound of live bird for 3.06 pounds of feed. At Connecticut in 1949, with 3600 birds, the average weight at 12 weeks was 4.06 pounds, or 1 pound of live bird for each 2.74 pounds of feed. In 1950 the first-place winners in both northeastern and southwestern regions of the United States averaged 5 pounds at 12 weeks.

Ducks are ready for market in 9 to 10 weeks, and squabs, weighing ¾ to 1 pound each are ready at 4 weeks. Turkey broilers at 9 to 10 weeks weigh 4 to 4½ pounds on 2.5–2.8 pounds of feed for each pound of turkey, or at 26 weeks reach a weight of 16 to 17 pounds on 4½ to 5 pounds of feed per pound of turkey. Geese at 8 weeks may reach 8.8 pounds and require 35.2 pounds of feed, or 4 pounds for each pound of weight.

Early sexual development. Pullets will be laying at 5 to 7 months of age, depending on the variety, season hatched, and the method of management. Pigeons mate at 6 to 7 months.

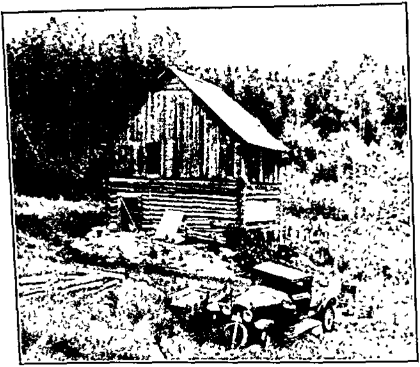

Fig. 14. Laying quarters for a small flock near Fairbanks, Alaska. Layers occupy the lower floor. (*Courtesy Harold E. Botsford, Jr.*)

Natural resistance to disease. Poultry, when properly bred and managed, possess natural vitality and ability to resist disease. Certain epizoötic diseases, against which a natural resistance has not been built, may be costly. Research, however, is aiding the poultryman in combating these diseases by developing vaccines and immunizing materials and by breeding. Birds are classified next to reptiles in the zoölogical scale of development, and both have great tenacity of life and possess other characteristics in common.

Natural instinct to distribute themselves according to the food supply makes it possible for large numbers of birds to be brooded, housed, and fed together, resulting in economy in housing and labor costs.

Layers are kept in flock units from a few to 7500 or more; broilers are brooded in flocks from 25 to 19,000; and chicks for layers are brooded from 25 to 600 under one brooder stove, or several thousand under long pipe-heated units. In field rearing predators may need to be fenced out, but chickens always come home to roost.

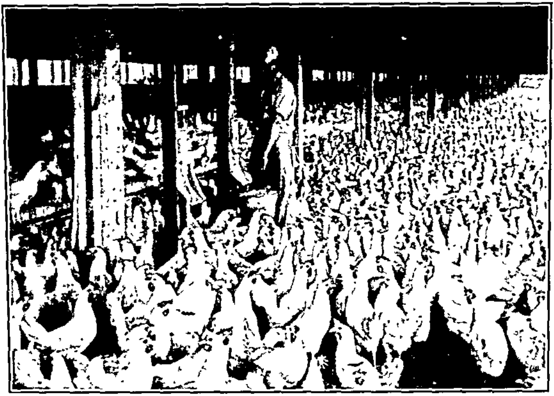

Fig. 15. One flock of 7500 layers on one floor The pen is 60' x 360'. This hen home consists of three floors, each similar to the one shown; 22,500 layers are accommodated under one roof. *(Courtesy G. F. Johnson, Pa. State Coll.)*

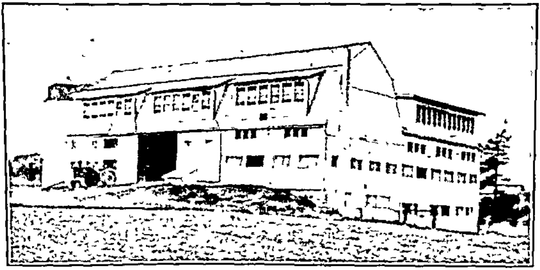

Fig. 16. A large dairy barn converted into a poultry house. Width, length, or height has proved no obstacle.

Ability to transform raw materials. It is estimated that 19 to 20 pounds of feed is required to maintain 100 Leghorns for 1 day, and that 1 extra pound is needed daily for each 10 per cent of production. Heavier laying varieties need 3 to 4 pounds more per day for maintenance.

3. Poultry husbandry is attractive as a business and a home farm enterprise.

A comparatively small amount of land is required. On general farms, when poultry is given free range, land is seldom fenced off entirely for the use of chickens. On commercial poultry farms and many small plants or ranches flocks are kept in confinement either in laying houses or in laying cages. Rearing chickens in confinement is becoming more common because of greater protection from predators, less labor cost, and excellent results from improved rations. Very little land other than that needed for the buildings is, therefore, required.

Pigeons, used for squab production, need only the land required for their house and about as much more for the outdoor flies. Ducks and geese require range and water. Turkeys, like chickens, are grown on range or in confinement.

There is quick turnover of capital. See pages 221 and 222.

Culling poultry is a well-developed art by which less productive, slow-growing, or poor-vitality birds may be removed from the main flock. This is accomplished more easily than with many other of our domestic animals.

The art of sexing baby chicks makes it possible to purchase pullet, cockerel, or straight-run chicks, depending upon any particular business need.

A small investment only is required for storage space, since poultry are almost entirely concentrate consumers and built-up litter is coming into more general use.

Less physical strength is required than with some other types of farming. The work may be accomplished under reasonably comfortable conditions of temperature and physical exertion, thus making it an interesting occupation for all family members.

Skill and painstaking care is necessary in considerable amount to succeed. This is an asset, since the lack of it removes many from the competitive field.

A great opportunity exists for originality in building and equipment design, in plant operation, and in management of the enterprise.

The day of specialization in poultry husbandry has arrived, and the many types of work from which the poultryman may choose include breeding, chick production, nutrition and ration building, or the production of eggs, broilers, capons, turkeys, ducks, geese, squabs, guineas, and the like

(*A*)

(*B*)

Fig. 17*A*. Orange County, Calif., poultry ranch with 4000 layers in single cages. Average, 212-230 eggs per cage; 110-125 per cent of flock renewed annually *B*. View down center aisle of one row of laying cages Eggs roll to the front on the wire bottom. Single water pipe runs the length of the cages at the rear and is equipped with one dewdrop waterer for each two cages

Services are available to the poultryman today, many of which a few years ago were limited in number and scope. States are providing information through research, instruction, and extension services. States also give protection by state police, by bonding and licensing operators, by promulgating egg-grade laws and regulations, by service and regulatory inspection, and by reports on market conditions and prices.

Credit is more easily obtained today than formerly by poultrymen. Life insurance companies and land banks provide long-term loan and mortgage services. Production credit association and short-term bank loans make available very pertinent assistance to poultrymen.

The federal service formulates standards of quality and grades for poultry and eggs as a guide for state use and for its own federal-state service; it also engages in various other types of research to benefit poultry keepers. Much of this material is published in popular bulletins.

Insurance is available from many sources for life, auto, fire, theft, and the elements.

Research by cooperatives and private concerns is extensive in feed, disease, and marketing, results of which are apparent in their products and services. Companies of this nature render many types of service to poultry keepers.

4. **Superior marketing conditions** are the result of producing a concentrated product in the form of eggs which, under proper farm holding conditions, need be shipped from the plant only once or twice each week to meet the constant demand that prevails. Eggs are particularly well adapted for storage and home preservation, their quality upon removal being dependent upon the quality that went in and on the storage or home holding conditions. Eggs in their original package are sold at retail in convenient numbers and at sizes and prices that appeal to any family group.

From squabs to geese or turkeys, a consumer may purchase a complete animal to meet his need. In many retail markets poultry is cut up into various parts such as dark meat, white meat, or soup stock, properly priced and displayed. This enables consumers to purchase according to meat preference and price.

5. **Poultry may be a full-time enterprise or a sideline** on a general farm, in a village or elsewhere, for men, women, or children, and under nearly any geographical condition.

Limitations

Every business has its limitations, and with poultry the normal *short life* means necessary renewal every year or two. The *small size* of each bird may cause one to lose sight of the individual and to reduce the care

of the flock to a mass basis, which may be an advantage since it permits grouping of large numbers and lower labor cost. A *small money value* may cause neglect of the individual unit.

Difficulty in controlling livability is one of the problems. The avian leukosis complex is at this writing among the greatest killers of chickens. Research has succeeded in reducing to the minimum losses from many other diseases and in time will solve the leukosis problem, it is expected.

Housing, ventilating, fertility, hatchability, brooding, incubating, producing, and *vitality* each presents problems to many poultry keepers. The *job of getting available information to* those who need it continues, as does research in determining the answer to these and other difficult matters.

In marketing, *breakage* due to the fragile nature of eggs, together with the numerous small units and their semi-perishable nature present difficulties in trading. In many sections the producer is handicapped by a *lack of quality and grade standardization* and consequent unfair competition from lower qualities.

Other problems may be securing the *needed supply of dependable labor, control of parasites, losses from stealing and other predators, fire,* and *lack of knowledge* as to where helpful information may be found.

The problem of *surplus* with both eggs and poultry is at times troublesome, especially to the marginal producer and to a lesser extent to those operating on a more steady basis.

Wrong strain for the job intended. Whether for broiler production, egg production, or other purposes, the proper strain is important. Broiler growers demand rapid feathering and quick growth found in certain strains but not in others.

Rate of production is capable of being well developed through breeding and selection, and future achievement of the pullet is already implanted in the chick's body at the time it is hatched. This potential ability, good or poor, comes with the chick when purchased. The wrong strain will not produce well regardless of the management it receives during growth and production. Success or failure may depend on the strain purchased.

4 · Prices, Receipts, and Purchasing Power of Eggs

Total market receipts of eggs, their relative price, and the general price level are beyond the influence of any poultryman.

A market-egg producer's financial success depends on all three.

Egg and poultry prices fluctuate around the general price level.

When the general price level is rising or high, poultrymen can purchase necessities more easily than when the general price level is dropping or low.

Millions of small flocks of layers start producing eggs at the end of the year and provide many market egg receipts in the spring.

Winter used to be a low-egg-receipt and high-egg-price season.

Summer and early fall are now seasons of lowest receipts and highest prices.

The best price control for the poultryman is his selection of the season of hatching.

The purchasing power of a commodity answers the question, "How am I doing?"

An important factor in the success of an individual poultryman is that adjustments can be made in the organization of the enterprise to take advantage of conditions over which he has no control. For example, in his own business it takes, and probably always will require, 3 weeks to hatch an egg and a rather definite time for pullets of various breeds to reach sexual maturity. However, the time of year to do this is a matter of the poultryman's own decision. Again, total receipts of eggs in a market and the relative price of those eggs are things over which he has no control and yet, by making certain adjustments in managing his enterprise, he can use these facts to his business advantage:

The general price level of all commodities.
The annual seasonal variation of receipts and prices of eggs.
General price fluctuations within seasons.
Opportunity for individual poultrymen to raise or lower the price range.
The purchasing power of eggs.

The opportunity exists generally for a poultryman to do better than the average, but aside from the seasonal rise and fall of prices his chances of receiving a high or low average annual price for his products depends on the general price level (G.P L.).

The General Price Level

This is the annual average of several hundred commodities in percentage of their average for certain years, such as 1910–1914; that is, the average for each year is divided by the 1910–1914 average. This gives for each year an index number of wholesale prices in the United States of 889 commodities (Fig. 18). When plotted, the curve indicates in general whether prices have gone up or down and what the trend in prices has been over a period of years.

Prices of individual commodities may be compared with the G.P.L. or with each other by determining their index numbers. In Fig. 18 the index number for the farm price of eggs is the annual average price of eggs, divided by the annual average price for the years 1910–1914 combined. This index number for eggs can be and is compared with the G.P.L., since both are using the same base.

Prices of individual basic commodities fluctuate around the G.P.L., and, although the price of any one may deviate for a time, it does not *stay out of line very long. Wages, taxes, debts, and retail prices change* very slowly. Poultrymen and other farmers sell basic commodities such as eggs or milk and pay out dollars for wages, taxes, and the like.

Egg prices are no exception to the basic commodity trends, and, whether the supply of eggs is great or little, the overall price will be related to the G.P.L. *The writer recalls eggs being sold in trade to the* country grocer at the home farm in Connecticut in 1898 for $0.08 a dozen. In 1920 a poultryman in western New York placed his foot on a 30-dozen crate of eggs and proudly exclaimed, "There are eggs to the tune of $30 in that case, and I've got three of them to ship tomorrow." *A glance at Fig. 18 will indicate the influence of the G.P.L. on these two* situations. A similar analogy might be drawn for 1933 and 1948.

The G.P.L. has risen sharply during war periods and has fallen quite consistently after the peak has been reached. At other times considerable instability has occurred. This instability in the G.P.L. creates a most important problem. When the G.P.L. is rising, prices that poultrymen and farmers generally receive for their products rise faster and farther than prices of things they buy. Such times are prosperous for poultrymen. When the G.P.L. is falling, the reverse is true, and prices of poultry products fall faster and farther than prices of things purchased. Such times should be periods of caution, of avoiding long-time commitments, of labor saving, of feed conservation, and of management efficient beyond the ordinary.

A study of the G.P.L. trend should help poultrymen over many rough periods in their efforts toward a successful poultry enterprise.

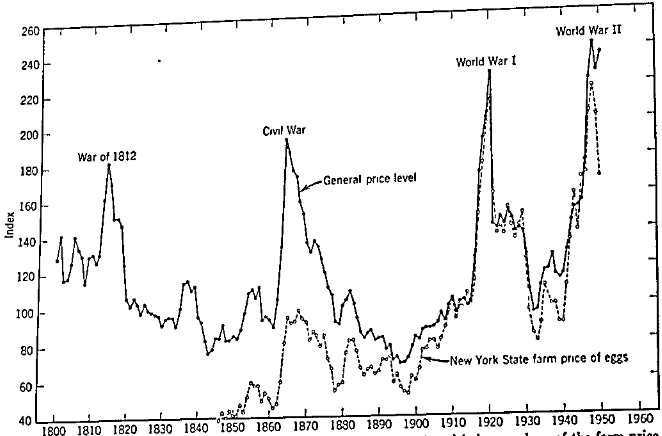

Fig. 18. The general price level of the United States (1910-1914 = 100) and index numbers of the farm price of eggs in New York State, 1846-1950 (Index numbers for the general price level from 1890 prepared by the U. S. Bureau of Labor Statistics. Index numbers, 1800-1890, prepared by Warren, Pearson, and Stocker of Cornell Univ. Index numbers for the farm price of eggs from S. E. Ronk, "Prices of Farm Products in New York State, 1841-1935," *Cornell Agr. Expt. Sta. Bull.* 643, March 1936.)

Table 10. Finding the Index of Seasonal Variation of Receipts of Eggs at New York City

A. Ratios of Receipts to Averages, 1942–1946

Month	1942				1943				1944			
	1	2	3	4	1	2	3	4	1	2	3	4
	Receipts	*Moving Totals of 12 Months*	*Moving Average*	*Ratios of Receipts to Average*	*Receipts*	*Moving Totals of 12 Months*	*Moving Average*	*Ratios of Receipts to Average*	*Receipts*	*Moving Totals of 12 Months*	*Moving Average*	*Ratios of Receipts to Average*
January	423,559	—	—	—	515,180	6,038,062	503,171.8	108.3	611,774	6,767,288	563,940.7	108.5
February	481,265	—	—	—	511,335	6,024,491	502,040.9	101.9	629,190	6,788,735	565,727.9	111.2
March	629,636	—	—	—	717,296	6,140,676	511,723.0	140.2	683,660	6,653,451	554,454.5	123.3
April	658,170	—	—	—	633,926	6,181,352	515,112.7	123.1	687,232	6,593,847	549,487.2	125.1
May	651,283	—	—	—	613,771	6,221,718	518,476.5	118.4	784,862	6,601,772	550,147.7	142.7
June	562,187	—	—	—	618,433	6,236,821	519,735.1	119.0	595,556	6,662,759	555,229.9	107.3
July	449,681	5,815,229	484,601.7	92.8	436,110	6,414,955	534,579.6	81.6	457,557	6,586,753	548,896.1	83.3
August	410,463	5,936,842	494,736.8	83.0	526,618	6,481,519	540,126.1	97.5	391,307	6,609,829	550,819.1	71.0
September	432,652	5,963,912	496,992.7	87.0	473,323	6,599,104	549,950.3	86.1	413,721	6,821,838	568,486.5	72.7
October	351,142	6,051,572	504,297.7	70.2	394,509	6,565,768	547,147.3	72.1	402,133	7,200,727	600,060.6	67.1
November	328,609	6,027,324	502,277.3	65.4	343,703	6,619,071	551,589.5	62.3	401,600	7,358,851	613,237.6	66.0
December	422,583	5,981,816	498,491.7	84.8	600,717	6,790,165	565,847.1	106.2	524,711	7,236,621	603,051.7	87.0

Month	1945				1946			
	1	2	3	4	1	2	3	4
	Receipts	*Moving Totals of 12 Months*	*Moving Average*	*Ratios of Receipts to Average*	*Receipts*	*Moving Totals of 12 Months*	*Moving Average*	*Ratios of Receipts to Average*
January	634,850	7,381,097	615,092.2	103.2	798,726	7,725,084	643,757.0	124.1
February	844,199	7,415,109	617,925.7	136.6	735,881	7,770,926	647,577.2	113.6
March	953,419	7,577,433	631,452.7	151.0	914,751	7,664,239	638,686.6	143.2
April	845,456	7,543,461	628,621.7	134.5	889,414	7,698,346	641,528.8	139.0
May	762,642	7,556,705	629,732.0	121.1	791,061	7,789,759	649,146.6	121.9
June	733,922	7,619,156	634,929.7	115.6	767,027	7,775,736	647,978.0	109.2
July	491,679	7,654,132	637,844.3	77.1	537,521	7,813,036	651,101.3	82.5
August	553,641	7,818,008	651,500.7	85.0	447,004	—	—	—
September	379,749	7,723,690	644,140.8	59.0	413,856	—	—	—
October	415,767	7,681,992	640,416.0	64.9	507,180	—	—	—
November	467,031	7,728,955	644,079.2	72.5	453,028	—	—	—
December	539,697	7,757,379	646,448.2	83.6	597,887	—	—	—

Table 10 (Continued)

B. Medians of the Ratios, 1912–1946

	January	February	March	April	May	June	July	August	September	October	November	December
	124.1	136.6	131.9	138.6	142.7	119.0	92.8 83.3	97.5	87.0	72.1	72.5	106.2
	108.5	116.7	143.2	134.5	121.9	116.5	82.5	85.0	86.1	70.2	66.0	87.0
	108.3	111.2	140.2	125.1	121.1	109.2	81.6	83.0	72.7	67.1	65.4	85.6
	103.2	101.9	123.3	123.1	118.4	107.3	77.1	71.0	54.9	64.9	62.3	84.5
Medians	108.4	113.9	141.7	129.8	121.5	112.8	82.5	84.0	79.4	68.6	65.7	86.8

C. Adjusting Medians to Find Index of Seasonal Variation, 1912–1946

	5 *Medians*	6 *First Adjustment*	7 *Final Adjustment*
January	108.4	108	109
February	113.9	114	114
March	141.7	142	142
April	129.8	130	130
May	121.5	121	122
June	112.8	113	113
July	82.5	82	83
August	84.0	84	84
September	79.4	79	80
October	68.6	69	70
November	65.7	66	66
December	86.8	87	87
	1195.1	1195	1200

D. Index by 5-Year Periods, 1910–1946, and 1947–1949 *

	1910–1914	*1920–1924*	*1925–1929*	*1931–1935*	*1937–1941*	*1942–1946*	*1947–1949*
January	48	57	67	84	98	109	122
February	67	77	87	94	91	114	101
March	127	155	147	134	129	142	131
April	187	175	177	154	147	130	136
May	199	173	166	163	152	122	127
June	145	144	137	127	126	113	112
July	104	102	99	97	101	83	86
August	92	86	84	83	82	84	74
September	82	75	72	73	74	80	71
October	68	64	61	68	67	70	78
November	40	45	47	58	60	66	71
December	41	47	56	64	72	87	91

* 1910–1941 by A. Van Wagenen (see [1]), 1942–1949 by author

The Annual Seasonal Variation of Receipts and Prices of Eggs

Receipts. Within any year there are definite trends in receipts of eggs in the markets of the country. To study the trend of egg receipts, a 60-month or 5-year *moving index of seasonal variation has been applied* to remove any current seasonal variation, and thereby to present a truer picture of the actual trend. With Tables 10 and 11 are shown the methods used to determine the index of seasonal variation of receipts of eggs:

I. *Longer Method for 5-Year Periods*

1. List receipts by months for each year of the 5-year period (Col. 1).
2. Total the 12 months' receipts in any year and place opposite July (Col. 2).
3. Starting with February and ending with January of the following year, total and place opposite August (Col. 2).
4. Repeat with March, April, etc., until the total of the last 12 months in the series is placed opposite July of the last year.
5. Average each figure in Col. 2 and place in Col. 3.
6. Find the percentage that each figure in Col. 1 is of the corresponding figure in Col. 3 (Col. 1 divided by Col. 3). Place in Col. 4.
7. Arrange the four January percentage figures (see Table 10, *B*) from highest to lowest under January, and repeat for each month. (There will be five figures for July.)
8. Find the medians for each month (average of two center figures if total number of figures is even, middle figure only if total number is odd).
9. Arrange medians, January to December, in Col. 5, and adjust to total 1200 (Cols. 6 and 7). Column 7 shows the index of seasonal variation for that period of years and for each month.

Table 11. Index of Seasonal Variation of Prices of Best Large White Eggs at New York City, 1947–1949

				1	2	3	4
	Average Monthly Prices						*Index*
	1947	*1948*	*1949*	*Totals*	*Average*	*Index*	*Adjusted*
January	0.507	0.584	0.551	1.642	0.547	88.2	88
February	0.479	0.573	0.482	1.531	0.511	82.1	82
March	0.537	0.533	0.513	1 583	0.528	85.2	85
April	0.547	0.547	0.572	1.666	0.555	89.5	90
May	0.523	0.515	0.566	1.631	0.515	87.9	88
June	0.568	0.634	0.597	1.799	0.600	96 8	97
July	0.636	0.675	0.670	1.981	0.660	106 1	107
August	0.702	0.741	0.722	2 165	0 722	116.4	116
September	0.760	0.755	0.741	2.256	0.752	121 3	121
October	0.737	0.806	0.666	2.209	0.736	118.7	119
November	0.729	0.739	0.595	2.063	0.688	111.0	111
December	0.681	0.620	0.475	1.779	0.593	95.6	96
				Totals	7 437	1202 6	1200
				Average	0 62		

II. *Shorter Method for a 3-Year Period, 1947–1949*

1. List receipts by months in parallel columns.
2. Total the three January receipts. Place in Col. 1.
3. Repeat for the other eleven months.
4. Average each of the twelve figures. Place in Col. 2.
5. Total and average Col. 2.
6. Find the percentage that each month in Col. 2 is of the average of Col. 2 (each month divided by the average). Place in Col. 3.
7. Adjust the resulting percentages to total 1200 (Col. 4). Column 4 shows the index of seasonal variation sought for the period of years and for each month involved.*

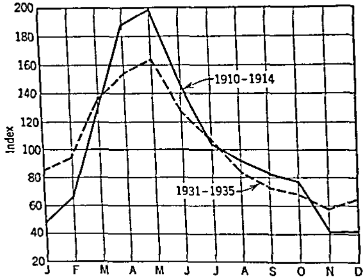

Fig. 19. Index of seasonal variation of receipts of shell eggs at New York City, 1910-1914 and 1931-1935 Eggs were scarce in the winter months of 1910-1914 but very plentiful in the spring Summer and fall were seasons of relative scarcity. Receipts in 1931-1935 were higher during the fall and winter months and lower in spring and summer than in 1910-1914. The period of scarcity came after July. (*Data from Cornell Univ. Expt. Sta. Bull.* 808.)

The seasonal supply of eggs has changed during the past 40 years in the New York City market, but so gradually it has often escaped notice. As late as 1910–1914 winter eggs were difficult to obtain, and receipts were low during late fall and winter. The importance of winter production and its accompanying high egg price was stressed for years. By 1931–1935 poultrymen were reacting to this. More eggs were arriving in the winter, and the supply situation was changing. By 1942–1946 the shift was becoming pronounced, and receipts during the three win-

* Example, Table 11. Seasonal variation of New York price of best large white eggs

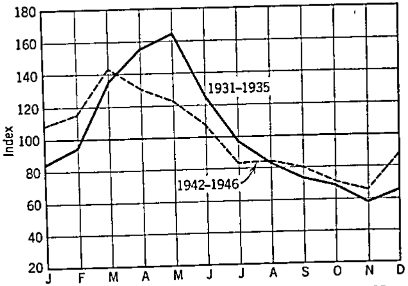

Fig. 20. Index of seasonal variation of receipts of shell eggs at New York City, 1931–1935 and 1942–1946. By 1942–1946 receipts were more plentiful during fall and winter and lower in the spring than in 1931–1935. The period of scarcity came after June. Production increased at a high rate during and following World War II. (*Source: same as for Figs.* 19 *and* 21.)

ter months December, January, and February were higher than during the summer and fall months. In later years, 1947–1949, the low point in receipts continued to be the summer and fall months, and late fall and winter receipts still increased and approached those of spring, which remained high. A particular reason for this is that production had been encouraged since 1940, due to the war and price supports. This influence has been largely effective among poultrymen who have smaller flocks and who generally hatch late in the spring, thus increasing winter production.

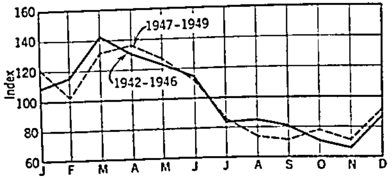

Fig. 21. Index of seasonal variation of receipts of shell eggs at New York City, 1942–1946 and 1947–1949. Late fall and winter receipts continue to increase. Poultrymen should be familiar with the changes in receipts and prices that have taken place. (*By author from figures supplied by U.S.D.A. Dairy and Poultry Market News Service, New York City.*)

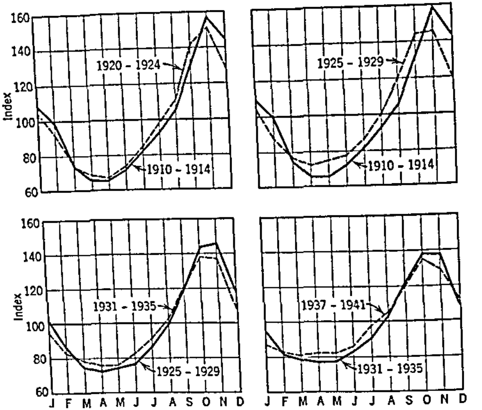

Fig. 22. Index of seasonal variation of the wholesale price for best large white eggs at New York City, by 5-year periods. (*Data from* "Changes in Seasonal Variations of the Wholesale Price of Eggs in New York City," *Alfred Van Wagenen, Cornell Univ. Expt. Sta Bull.* 808, 1944.)

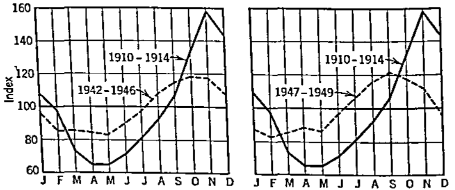

Fig 23 Index of seasonal variation of the wholesale price for best large white eggs at New York City, by 5-year periods. (*Sources:* 1910–1914 *data from Cornell Univ. Agr Expt Sta Bull* 808, 1942–1946 *and* 1947–1949 *by author from figures supplied by U.S.D.A dairy and poultry statistics*)

Therefore, it is seen that, whereas winter used to be the season of low receipts, the trend by 1947–1949 had changed. Summer and fall are the seasons of egg scarcity.

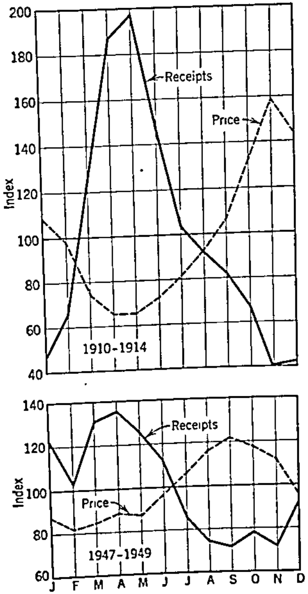

Fig. 21. Index of seasonal variation of receipts of shell eggs and the wholesale price of large white eggs at New York City. Receipts and the price of eggs in New York City during 1910–1914 were noted for their extremes. The high winter price stimulated greater production. It has taken many years to bring about a change. The current period of shortage is summer and fall.

Prices. Accompanying the shifts in receipts of eggs are changes in the seasonal variation in price of eggs.* In 1910–1914 the peak of

* Comparisons and effects on prices are made on best large whites. For data on other sizes and qualities, figures up to and including 1913, see *Cornell University Agricultural Experiment Station Bulletin* 808.

prices came in November, and the months of high prices were October, November, and December. Few eggs were produced and received in the market at that season. January and September were relatively high, but from February to August, inclusive, prices were low. The market was flooded with eggs from March to July, inclusive. Storage

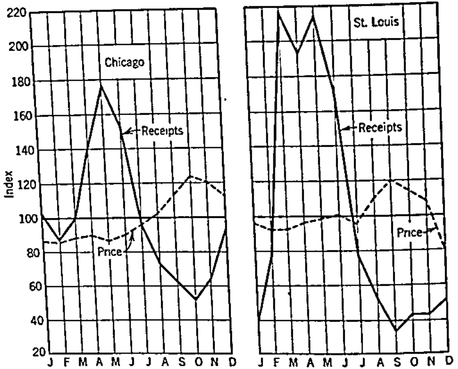

Fig. 25 Index of seasonal variation of receipts of shell eggs and the wholesale price of large white eggs at Chicago, 1947–1949, and St Louis, 1949 (*By author from data supplied by U.S.D.A. Dairy and Poultry Market News Service and market statistics*)

of eggs was important then, and, during the spring season, packing eggs for storage was big business. These eggs were removed in the late fall and winter and placed on the retail market. Figures 23 and 24 show the tendency of prices in later years to follow the 1910–1914 prices, except that there was a gradual leveling of the annual price. The December price has continually dropped lower, the peak price has moved backward to October and even September, and July to November inclusive have become high-price months. In each succeeding period prices have not gone quite so low in the spring nor so high in the winter. The upward price bulge has raised July and August to important price months, and is influencing May and June in the same direction.

Currently winter is a low-price period, and from June until November high prices prevail.*

The change that has taken place in the relation of egg receipts and prices at New York City since 1910 is shown in Fig. 24. Spring has remained the season of high receipts and low prices. December and January were, during 1947–1949, among the low-price months.

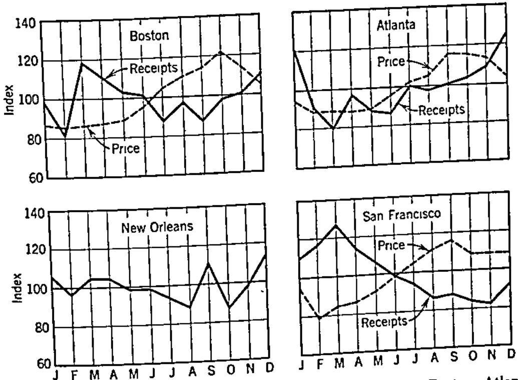

Fig. 26. Index of seasonal variation of receipts of shell eggs at Boston, Atlanta, New Orleans, and San Francisco for 1947–1949. (*By author from data supplied by U.S.D.A. Dairy and Poultry Market News Service at Atlanta and St. Louis and U.S.D.A. dairy and poultry market statistics.*)

Chicago and St. Louis for 1947–1949 and 1949, respectively, still had heavy receipts during the spring and to a greater degree than existed in several other markets. In both cities receipts from June to December were low, with an upward swing occurring in December and a corresponding lowering of price. Receipts of eggs were showing some tendency to level off in New York, San Francisco, Boston, and New Orleans. Boston, New Orleans, and Atlanta had more nearly uniform receipts throughout the year, although they differ seasonally from each other. The relation between receipts and prices of large white eggs is similar across the continent.

* Egg prices held at a high point through December 1950. Whether this will continue remains to be seen.

General Price Fluctuations within Seasons

Variations in price occur within the annual seasonal variation. Natural forces tend to hold prices at levels dependent on the season of the year, known supplies, and the like. When supplies of eggs are large, prices drop and stimulate purchase and consumption. When receipts of eggs are light, prices move upward, consumption may continue, and more eggs, if available, are attracted to the market.

Very cold, stormy, or very warm weather tend to strengthen egg prices, since all may reduce production in many flocks. Long periods of weather favorable to egg production may be accompanied by lower prices.

It is usually safe procedure for the poultryman to keep all eggs moving through his regular outlets, and, by varying the season of hatching, to regulate the supply he has available at any particular season.

Opportunity for the Individual Poultryman in Price Improvement

At any annual or seasonal point, poultrymen may often improve their particular price situation above the average by:

1. Purchasing stock, if and when it can be found, which has been bred to lay large numbers of eggs with a large amount of thick white (albumen), and of desirable size, shape, color, and texture of shell.
2. Handling the product so as to receive maximum returns. Examples are: maintaining quality in eggs by using proper rooms for holding, cleaning, and sizing eggs; cleaning, sizing, and packing correctly; and by shipping full cases. See [2] and [3] for more detailed information.
3. Seeking better outlets for the product. For example, occasionally a retail trade may return more than the extra costs involved and, hence, be better than a wholesale market.
4. Studying the effect of the season of hatching.
5. Applying a different system of management.

The Purchasing Power of Eggs

We have found that prices of eggs are related to the G.P.L., to the receipts of eggs in the markets, and to weather conditions. We shall see that the price of feed poultrymen must buy is an important factor in determining net returns It can be expected that the prices of other things poultrymen buy may likewise influence living conditions, both commodities needed to carry on the business and things needed in the household. The actual price of eggs in dollars and cents may not tell us whether eggs are high or low comparatively, since what the poultryman can buy will depend on the relation of the price of eggs to the price of other things. A method of measuring the price of eggs, for example, with other prices is by calculating the "purchasing power" of eggs. This

tells us whether the price of eggs is rising or falling in terms of other things.

The purchasing power of a commodity (eggs) is the percentage that the index number of eggs is of the corresponding index number of all commodities (G.P.L.).

For example: in 1949 the index of the New York farm price of eggs was 202. The all-commodity index (G.P.L.) was 226. The purchasing

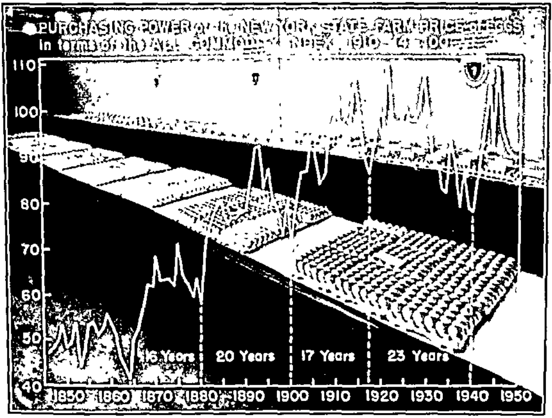

Fig 27.

power of the farm price of eggs in New York State was 89.4 (202 ÷ 226 × 100), or 10.6 per cent less of other things could be bought with a dozen eggs than in the 1910–1914 period.

To put it another way, the price of eggs in 1949 (202) was twice as high as in 1910–1914. The price of many other commodities was two and one-quarter times as high (226) as in 1910–1914. Therefore, although egg prices were favorable in cents per dozen, 1 dozen eggs in 1949 would not buy quite as much as 1 dozen eggs in 1910–1914. The purchasing power in 1949, therefore, was not as good as the purchasing power in 1910–1914. See Fig. 27. In 1940 it was considerably below, whereas in 1943 and 1945 the purchasing power of eggs was considerably higher than, that in 1910–1914. Eggs in 1943 and 1945 would buy more of other commodities than in 1940, and conditions for the poultryman were better.

The general trend of the purchasing power of eggs shows that from 1864 to 1930 eggs were improving generally as compared to the price of other things. From 1930 to 1940, through the depression years, the purchasing power of eggs was hit harder than the purchasing power of many other things, and the trend was downward and therefore less favorable. World War II improved conditions for the poultryman, but, since 1945, the trend has again been downward, and a dozen eggs therefore could not buy quite as much as before.

Observe that the purchasing power of eggs appears to go in cycles of 16–23 years; that is, a low point in the purchasing power of eggs is reached in about that length of time. In between these cycles, at least one low and one high point is shown. There appear to be two minor cycles within each major cycle; 1949 was about halfway through another major cycle and may be a low point of a minor cycle. Time will tell. The aftereffects of the war, price supports, and other economic upsets may have an unusual effect on the purchasing power of eggs at this time and later.

Changes in the relative value of eggs and other farm commodities are taking place all the time, and poultrymen and would-be poultrymen would do well not to be drawn into the enterprise simply because prices are high, nor, once in, be led to liquidate because of temporary low prices.

To convert the index numbers of all commodities from the 1910–1914 base to the 1935–1939 base:[4]

1. Find the sum of index numbers for 1935–1939 inclusive. 117 + 118 + 126 + 115 + 113 = 589
2. Divide 5 by the sum = 0 00849
3. Multiply each index number (1910–1914 base) by 0.00849
4. The result is a new set of index figures on the 1935–1939 base
5. To check accuracy: the sum of the new index numbers for the years 1935–1939 should equal 500. 99 + 100 + 107 + 98 + 96 = 500

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5 · Market-Egg Production

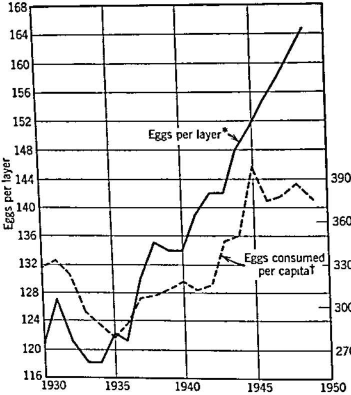
In summary, as of 1950:

1. Total egg production is high but declining slowly.
2. Farm egg consumption holds fairly steady through the years.
3. *Eggs per hen have increased quite steadily since 1936.*
4. Consumption per person increased from 1935, but has tapered off since 1945.
5. The prices of feed and eggs are not necessarily related.
6. Given the same percentage increase or decrease on prices of feed and eggs, that of eggs is of greater importance.
7. A high egg-feed ratio is desirable.
8. An egg-feed ratio of 1:10 is near the dividing line between losing and gaining financially in market-egg production.
9. A low feed-egg ratio is desirable.
10. Beyond maintenance, only a small amount of feed is needed for egg production.
11. Pullets lay more eggs than hens.
12. Annual renewal of 100 per cent with heavy breeds appears sound.
13. *For light breeds, 75 to 80 per cent pullets and the balance hens give desirable results.*
14. A rest period will frequently result in better second-year production.
15. Combining the pullet flock with yearlings held nearly or quite until the end of their laying year appears to be good poultry-flock management.

Egg production in the United States increased more than 101 per cent from 1910 to 1948. It dropped nearly 14 per cent during the depression years from 1930 to 1935. From 1935 to 1944 the increase in eggs produced on farms, as well as total eggs produced, including nonfarm production, was over 70 per cent. These were profitable years for poultrymen. The general price level had started up after 1933 and was still rising rapidly after 1944. A special request for increased production in the early 1940's showed its effect by 1944 in an all-time high in layers and egg production. A return to normal started during 1945 and is continuing. The number of layers and total eggs produced continues high at this writing.

The average number of layers on United States farms in 1949 dropped 55 million in the 5 years after 1944. The remaining millions continued to lay more eggs on farms than they had before by 17 eggs per bird, so that the total eggs available for sale from farms decreased only slightly over 4 per cent.

Egg consumption has held up well. The Poultry and Egg National Board, assisted by many other organizations and individuals, has done a fine job of holding the interest in eggs and poultry. Consumption of eggs dropped from 329 per capita in 1930 to 278 in 1935, but then



* Number of eggs produced during the year, divided by the average number of hens and pullets of laying age on hand during the year.
† Beginning with 1941, consumption figures apply only to civilian population.

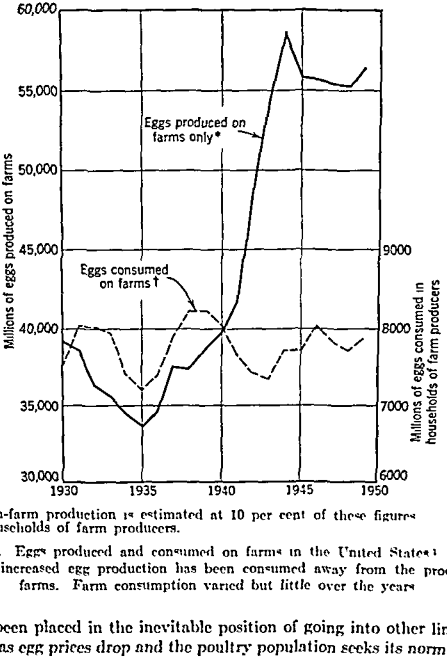
Fig 28 Production of eggs per hen and consumption of eggs per capita in the United States, 1930–1948[1] Production per layer increased 36 per cent from 1936 to 1949. Per capita consumption increased 35 per cent from 1935 to 1949.

showed a remarkable rise and held between 374 and 397 from 1945 to 1949.

Most of this increase in consumption of eggs has been off the farm, as eggs eaten on farms where produced has varied but a few hundred million since 1930 The number consumed on farms dropped in 1935 to slightly over 7 billion, rose in 1938 and 1939 to slightly over 8 billion, and in 1949 was 7 8 billion.

Since 1941 the consumption figures apply to the civilian population only Many eggs since World War II have been purchased by the

federal government under the price-support plan. This incentive, which occurred during an exceptional rise in the general price level, was partly responsible for the increase in egg production. Some poultrymen have



* Non-farm production is estimated at 10 per cent of these figures
† Households of farm producers.

Fig. 29. Eggs produced and consumed on farms in the United States.[1] Most of the increased egg production has been consumed away from the producing farms. Farm consumption varied but little over the years

since been placed in the inevitable position of going into other lines of work, as egg prices drop and the poultry population seeks its norm.

The period during early 1950 called for efficiency in operation and business judgment in poultry management. Luckily conditions improved in 1951.

Future trends should be studied and advantage taken of the opportunities that occur.

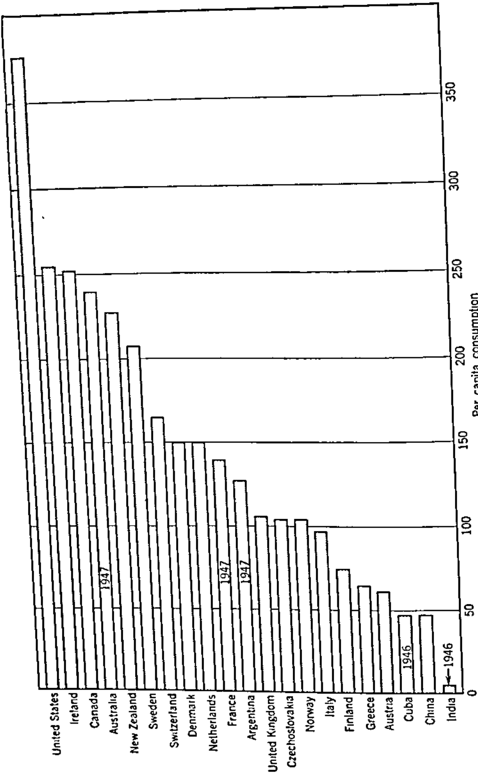


Fig. 30. Consumption of eggs per capita by countries. Figures for 1949 except as indicated. (*World's Poultry Sci. J.*, July–September 1950, 6: 3.)

Feed and Eggs

There is not necessarily a relationship between the cost of feed and the price of eggs. It has been incorrectly said, "When eggs are low in price, feed should also be low." The price of feed is dependent on many factors and on many uses for feed. Poultry consumed about 23.5 per cent of the total used by livestock in 1947. In addition, the feed used by humans for food and other products is enormous.

From 1919 to 1944, the poultry requirement for grain increased 97.2 per cent, or from 13 million tons to nearly 26 million tons. By 1947 the grain consumed by poultry had decreased nearly 5 million tons. From 1944 to 1947 the poultry population on farms in the United States decreased as follows: number of hens and pullets, about 88 million; all chickens, 108 million; chickens raised, nearly 87 million; and turkeys raised, nearly ¾ million.

Poultry are heavy consumers of grain and from 1931 through 1947 were second only to hogs. From 1919 to 1930, inclusive, horses and mules occupied second place in the use of grain by livestock. From 1939 to 1947 dairy cattle were the third-largest users of grain.

It will be seen that grain has many uses. The price of grain may be influenced in other countries as well as in the United States, by such conditions as yield and demand; the needs of poultry have nothing to do with either of these. Poultrymen, as well as dairymen, beef cattlemen, and other livestock growers, must take their chances concerning the availability of grain and its price when they are dependent on the market for their supply.

Poultry are more dependent upon the grain supply than nearly all other types of livestock. A shortage or a price out of proportion with the price of poultry products may spell disaster to the poultryman. When he embarks on a project of producing market eggs, his success may depend largely on the price of eggs and its relation to the price of feed.

In a few instances a poultryman may be equipped with the land, tools, and labor to grow a large part of the feed necessary, and to do it at a lower net cost than if he had to buy it. One-half or more of the total ration may be grown. Since whole farm-grown grains may be ground and mixed with a mash concentrate, mixed by commercial feed companies for this purpose, a still larger part of the entire ration may be grown.[10]

Effect of Percentage Increases on Feed and Eggs

A similar percentage increase on feed and egg prices may not have an equal effect on the net returns. A percentage increase applied to the

price of 100 pounds of feed will result in an increase in the cost of feed for 1 hen a year. The same percentage increase in the price of 1 dozen eggs may increase considerably the return from the sale of her eggs as it is applied to a larger number of units.

For example, assume a White Leghorn hen consumes 115 pounds of feed that cost $4.25 and produces 188 eggs selling at $0.54 per dozen:

115 pounds feed	$4.25
15⅔ dozen eggs @ $0 54	8.478
Difference	$4.228

Assuming 10 per cent increase in feed cost and price per dozen:

115 pounds feed	$4.675
15⅔ dozen eggs @ $0.594	9.326
Difference	$4.651

An increase of 10 per cent in the price of feed and eggs has given a gain of $0.423 per layer. In this case feed would need to rise 19.95 per cent to equal a 10 per cent rise in the value of eggs.

The egg-feed ratio * is the number of pounds of feed 1 dozen eggs will buy. When the ratio is wide, egg production is relatively profitable, and, when the ratio is narrow, the business is less profitable. The egg-feed ratio refers to the relationship between the price of eggs and the price of feed.

Poultrymen are engaged in transforming a bulky product (feed) into concentrated products (eggs and meat). When the price of feed is low the cost of the finished products is reduced. If at the same time the price of the finished products should be high, the egg-feed ratio will be wider and the business more profitable.

Feed cost is 50 to 60 per cent of the total cost of producing eggs. It is a large cash cost and one which presents itself with great regularity. Since it is the most important cost, it can be used in the egg-feed ratio to indicate whether egg production is relatively profitable at any time.

Using the egg-feed ratio as a guide to profits in egg production, we find that the years 1942 and 1943 were outstanding. The egg producer has enjoyed a long period of favorable years (Table 12).

New England and the Middle Atlantic states were the most favorable locations for market-egg production in 1948 and 1949 (Table 13). In no section of the United States were conditions very unfavorable; 1948

* Obtained by dividing the price of 1 dozen eggs by the price of 1 pound of feed. This gives the number of pounds of feed 1 dozen eggs will buy.

Table 12. Egg-Feed Ratios

(United States Average, 1938–1947)

Year	*Egg-Feed Ratio* *	*Poultry Ration Cost per 100 Pounds* †
1939–1948 average	12.4	$2.77
1940	11.5	1.68
1941	13.5	1.83
1942	14.2	2.21
1943	14.5	2.66
1944	11.5	2.94
1945	13.4	2.91
1946	11.3	3.47
1947	11.1	4.17
1948	11.4	4.29
1949	13.2	3.46

* Number of pounds of poultry ration equivalent in value at local market prices to 1 dozen eggs. Simple average of monthly ratios.

† Simple average of monthly ration costs.

was a good year; 1949 was better. In the New England states, which had a high egg-feed ratio both years, the poultry ration cost the most. The price of eggs, therefore, must have been high, resulting in a wide ratio. To determine the approximate average annual price prevailing in a section for a given year, the egg-feed ratio is multiplied by the price of feed per pound. Examples: for New England in 1949, 14.6 × $0.0416 = $0.607 (thus a high egg price may offset high feed prices); for the West South Central area, 12.3 × $0.0351 = $0.43.

Table 13. Egg-Feed Ratios by Regions of the United States [1]

(Arranged High to Low for 1949)

	Egg-Feed Ratio		*Poultry Ration Cost per 100 Pounds*	
Region	*1948*	*1949*	*1948*	*1949*
Middle Atlantic	13.5	15.0	$4.60	$3.76
New England	13.7	14.6	4.98	4.16
Mountain	12.3	13.3	4.12	3.59
East North Central	11.1	13.1	4.22	3.29
South Atlantic	11.5	13.0	4.75	3.03
West North Central	10.5	12.9	3.89	2.99
Pacific	12.3	12.8	4.68	4.12
East South Central	10.7	12.4	4.49	3.54
West South Central	10.7	12.3	4.27	3.51
United States	11.4	13.2	4.29	3.46

For many years various colleges of agriculture have issued weekly or monthly reports of feed and egg prices and the egg-feed and broiler-feed ratios. To illustrate the influence of prices on the egg-feed ratio, a table and chart were prepared from figures released by Cornell University for the period July 1948–June 1950. See Table 14.

Table 14. Price of Feed and Large White Eggs, and Egg-Feed Ratio[a]

(Approximate Figures at the Start of Each Month)

Month	*Feed* *	*Eggs* †	*Egg-Feed Ratio* ‡
1948			
July	$5.16	$0.62	12.0
August	4.78	0.68	14.2
September	4.55	0.70	15.3
October	4.38	0.77	17.5
November	4.21	0.76	18.0
December	4.30	0.68	15.9
1949			
January	4.28	0.60	14.0
February	4.21	0.45	10.7
March	4 19	0.48	11.6
April	4.29	0.50	11.7
May	4.38	0.55	12.5
June	4.29	0.55	12.9
July	4.17	0.54	13.0
August	4.15	0.69	16.7
September	4.11	0.74	18.0
October	4.03	0.71	17.6
November	3.96	0.56	14.1
December	3 94	0.61	15.5
1950			
January	3.99	0 44	11.0
February	3 98	0.33	8.5
March	3.97	0.37	9.3
April	4.04	0.39	9.6
May	4.15	0.39	9.4
June	4.29	0 35	8.0
July	4.16	0.44	10.5
August	4.36	0 55	12.6
September	4.24	0 58	13.6
October	4.24	0.59	13.9
November	4 27	0.60	14.2
December	4.37	0.62	14.2

* Rochester-Syracuse zone

† Wholesale price of large white eggs in New York City, less $0 03.

‡ Pounds of feed 1 dozen eggs will buy.

The period in Table 14 includes favorable months and also one of the poorest since February 1950. Points demonstrated in this period of 24 months are:

1. Feed is less of an influence than egg prices.
2. The egg-feed ratio closely followed the general trend of egg prices.
3. In the fall of 1948–1949, egg prices were high, feed was tending downward, and the egg-feed ratio was favorable.
4. From February 1950 through May 1950, a slightly rising feed price was accompanied by a slightly rising egg price. The egg-feed ratio held with little variation.
5. In June, a rise of \$0.14 per 100 pounds of feed and a drop of \$0.04 in the egg price lowered the egg-feed ratio 1.4 points.
6. From February to June 1950, feed had advanced \$0.31; however, eggs rose \$0.02. The egg-feed ratio dropped only 0.5 point.

The Significance of the Egg-Feed Ratio

A ratio of 10 or below may be considered poor, from 10 to 14 fair to good, and above 14 excellent.

A Poor Ratio

An egg-feed ratio of 10 requires 1 dozen eggs to buy 10 pounds of feed, or 10 dozen eggs to pay for 100 pounds of feed.

Assuming feed is 60 per cent of total costs, 16.7 dozen are necessary to pay all costs.

16.7 dozen eggs = 200 eggs

200 eggs daily by 400 hens = 50% production

Four hundred leghorns laying 50 per cent should consume about 100 pounds of feed daily; therefore an egg-feed ratio of 10 will pay approximate total costs at 50 per cent production.

A Fair-to-Good Ratio

Egg-feed ratio of 14 = 7.1 dozen eggs to pay for 100 pounds of feed.

Egg-feed ratio of 14 = 11.8 dozen eggs to pay total cost of eggs produced by 400 layers in 1 day.

141.6 eggs daily for 400 layers = 35.4 % production.

Therefore, an egg-feed ratio of 14 will pay approximate total daily costs of 35.4 per cent production and will yield 14.6 per cent of the eggs at a profit assuming 50 per cent production.

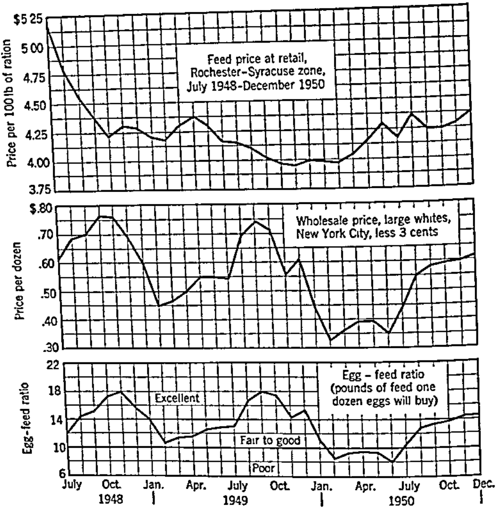


Fig. 31. Egg-fed ratio, July 1948–December 1950. Higher feed and lower egg prices combined to produce a lower egg-feed ratio during 1950 than in 1948 and 1949. (*Figures from* "Poultry and Eggs," *by Wendell Earle, Cornell Univ.*)

An Excellent Ratio

Egg-feed ratio of 18 = 5.6 dozen eggs to pay for 100 pounds of feed.

Egg-feed ratio of 18 = 9.25 dozen eggs to pay total cost.

111 eggs daily for 400 layers = 27.75% production.

Therefore, an egg-feed ratio of 18 will pay approximate total daily costs of 400 layers with 27.75 per cent production and yield 22.25 per cent at a profit assuming 50 per cent production.

Better egg prices are influential in improving the egg-feed ratio. Although better production does not affect the egg-feed ratio, it does have

a most important bearing on profits at any egg-feed ratio level. In the examples cited an increase in production would increase returns.

Feed Required at Different Production Levels

The relatively small amount of feed above maintenance requirements for any given production has often been referred to in current writings. We have shown the importance of high production in returning profits. The obvious conclusion is to full feed for maximum production regardless of feed cost if the aim is to make the best egg-feed ratio. Not only is feed intake dependent upon rate of production, but also it varies with the size of bird. The poultryman may desire to determine:

a. The feed required per 100 birds per day when the average live weight and number of eggs per day are known.

b. The feed cost per 100 birds per day.

c. The feed cost per dozen eggs.

The nomograph saves many multiplications and divisions and, like an engineer's slide rule, reduces computations to the minimum once it is mastered.

The Nomograph in Determining Feed and Other Costs of Producing Market Eggs

Its use is very simple. Lay a ruler or other straight edge across line *A*, representing the average live weight of the layers, and line *B*, representing either per cent production or number of eggs per hen year. The point at which the straight edge crosses line *C* will represent the number of pounds of feed per 100 birds per day or per hen year, whichever figure you use. Mark the point of intersection on line *C*. Next lay the straight edge across the point marked on line *C* and the proper price of feed on line *D*. Mark the point of intersection on line *E*. This point at which the straight edge crossed line *E* will be either feed cost per hundred birds per day or per hen year, whichever you choose to use. Now lay the straight edge across the point marked on line *E* and that point on line *G* representing the proper number of eggs per hundred birds per day or per hen year. The point at which the straight edge crosses line *F* will be the feed cost in cents per dozen eggs.[4]

The feed-egg ratio is the number of dozens of eggs it will take to buy 100 pounds of feed. This method of determining ratios is used almost entirely on the Pacific Coast and to a more limited extent elsewhere in the United States. Feed is usually purchased by the 100 pounds, and it takes about 100 pounds per day to feed 400 Leghorns laying 50 per cent. If the feed-egg ratio is 13, for example, it will require 13 dozen or 156 eggs, or 39 per cent production per day, to buy 100 pounds of feed or sufficient feed for 1 day. If production is 60 per cent, the poultryman will have 21 per cent with which to meet other

costs and profit. Obviously, a *low* feed-egg ratio is desirable financially and is brought about by high egg prices or low feed prices. However, both ratios cover but two factors, and indicate whether conditions are good or poor, and not how profitable any particular business may be.

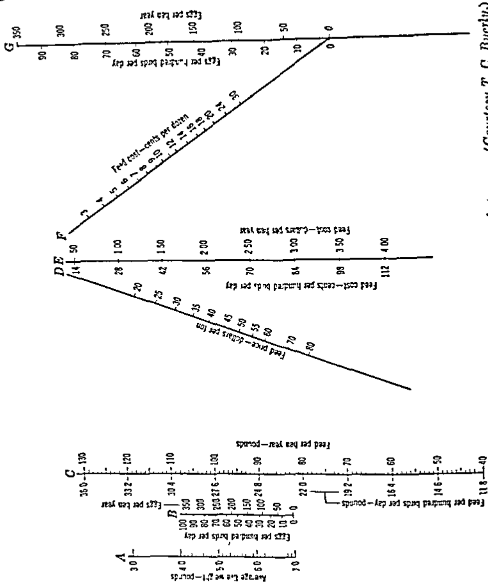


Fig. 32. Nomograph for determining costs of producing market eggs. (*Courtesy T. C. Byerly.*)

It will be recalled that the egg-feed ratio is influenced by the same factors and that a high egg-feed ratio is most desirable for the poultryman.

The feed-egg ratio has been relatively low for many years in certain sections of California. In 1943 profits averaged $1.89 per hen on 25 farms in Los Angeles County; the feed-egg ratio was nearly the same as that in 1936; however, feed costs in 1943 were 67 per cent above 1936, whereas the price of eggs per dozen was 75 per cent higher. This favor-

able situation combined with a higher rate of production more than doubled the 1943 management income per bird over that for 1936. Since the flocks averaged 312 more layers, the total profit presumably was considerably more (Tables 15 and 16).

Table 15. Relation of Feed-Egg Ratios to Other Management Factors in Los Angeles County, California [a]

	1936	*1943*	*1945*	*1948*	*20-Year Average*
Average cost of all feed	$1.65	$2.70	$3.18	$5.00	$2.47
Average price per dozen eggs	$0.251	$0.441	$0.462	$0.579	$0.327
Management income	$0.73	$1.89	$1.66	$1.32	$0.53
Feed-egg ratio	6.9	6.6	7.3	8.8	7.8
Number of records	10	25	17	14	21
Average size of flock	1129	1441	1503	921	1385
Average production per bird	153	169	179	202	159

Table 16. Feed-Egg Ratios in Several California Counties [a]

County	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*
San Bernardino	7.0	6.6	8.2	7.3	8.3	7.6	—
Alameda	6.8	5.7	7.7	7.0	7.9	7.8	8.0
Los Angeles	7.1	6.6	8.6	7.3	8.3	8.1	8.8
Sacramento	5.9	5.8	7.1	6.7	8.1	8.0	7.6

[a] From annual reports of the respective counties.

Pullets *vs.* Hens in Egg Production

In recent years there has been a trend toward more pullets in the laying flock. Pullets lay more eggs generally than hens. Hens are handicapped in at least 2 ways. First, after a year of heavy production, a hen has reached old age, her productive ability is reduced, and she is likely to lay fewer eggs. Individuals may vary from this usual procedure, but flocks tend to follow it. Second, practically all layers at the completion of their laying year go through a rest period, the length of which depends on the bird's ability as a producer. During the rest period, molting occurs, and a general building-up process takes place, all of which occupies several weeks.

When this rest period is deducted from a second 12 months of laying, the hen is at a disadvantage when compared with the first 12 months of a pullet's laying life.

It may cost nearly $2.00 to rear a pullet, whereas a hen may be held through the rest period of 2 months on 14 pounds of feed, or nearly that, plus any other costs. Some sacrifice in eggs may be justified, since the hen's first cost is spread over 2 years and her eggs are large during the second year, thus commanding the top market price.

Should the meat value of the hen nearly or quite offset the cost of raising a pullet to replace her, the extra eggs laid by the pullet may justify 100 per cent renewal.

Heavy breeds may often pay better with 100 per cent renewal. Light breeds may be found more profitable when 20 to 25 per cent of the flock is hens.

When discussing the value of 100 per cent renewal, it is well to differentiate between: (1) disposing of all birds during the first 12 months of laying, and (2) keeping the birds that are in production to the end or nearly the end of the first laying year.

An example of (1) is the 12-month laying system and of (2) the barracks range system. When either the barracks range system or the barracks confinement system is practiced, a culled flock may be held in production for about 18 months and, hence, may be considered as hens for 6 months of that time. The laying flock, under this method, will consist of the current season's pullets in their first 12 months of lay plus last season's pullets, finishing their first laying year. Such a procedure appears desirable from records taken on New York, Indiana, and California poultry farms engaged in the production of market eggs.

The New York records divide the flocks into those of light breeds having fewer than 70 per cent, 70 to 99 per cent, and 100 per cent pullets, and those of heavy breeds having 100 per cent or less than 100 per cent pullets (Table 17).

Table 17. Relation of Proportion of Pullets to Costs and Returns,[7] in Cents, 135 New York Farms, 1946–1947

	Light Breeds			*Heavy Breeds*	
	Less than 70 per cent Pullets	*70–99 per cent Pullets*	*All Pullets*	*Less than 100 per cent Pullets*	*All Pullets*
Number of farms	36	27	19	12	41
Average number of layers	1139	1102	1002	566	628
Eggs per layer	171	177	181	164	183
Costs per dozen eggs					
Feed	31.2	30.2	31.6	34.2	31.4
Labor	9.1	8.7	7.5	10.8	9.3
Buildings and equipment	3.3	3.5	3.5	4.9	3.5
Depreciation	6.7	6.8	6.3	2.7	2.4
Other	2.7	3.0	2.5	4.5	3.5
Total	53.0	52.2	51.4	57.1	50.1
Returns per dozen eggs					
Eggs	55.3	55.5	53.5	54.6	50.4
Other	0.2	0.4	0.3	0.5	0.6
Total	55.5	55.9	53.8	55.1	51.0
Net cost per dozen eggs	52.8	51.8	51.1	56.6	49.5
Profit per dozen eggs	2.5	3.7	2.4	−2.0	0.9
Return per man-hour	81.1	90.0	81.2	50.4	68.5

All-pullet flocks, both light and heavy breeds, had a higher number of eggs per layer, and the net cost per dozen eggs was less. The price received was less per dozen due to egg-size difference

The all-pullet *light breed* flocks, although producing eggs at a lower cost, returned a lower egg price, and the profit per dozen was $0.024. Flocks having 70–99 per cent pullets made a profit of $0.037 per dozen and returned $0.088 more per man-hour.

Heavy-breed all-pullet flocks returned slightly more for eggs than it cost to produce them and gained $0.009 per dozen. Heavy-breed flocks with fewer pullets, although receiving a higher net price per dozen, produced too few eggs and lost $0.02 per dozen.

Indiana [6] farms showed best results when they contained about one-quarter healthy yearling hens. Such flocks used more labor per hen but gave higher production and higher labor returns per 100 hens and per hour. Data for 1945–1946 are shown in Table 18.

Table 18

	Percentage of Pullets		
	0–67 [a]	*68–93*	*100*
Number of flocks	11	12	76
Average percentage of pullets	56	78	100
Egg production per hen	140	163	158
Average number of hens	170	157	156
Average price per dozen eggs	$0.39	$0.38	$0.39
Man-hours per hen	2.9	3.4	2.8
Labor returns [b] per 100 hens	$2.00	$111.00	$83.00
Labor returns per hour	$0.18	$0.42	$0.35

[a] One abnormal flock omitted from this group.

[b] Labor returns = Total returns − (Total costs − All labor, paid or unpaid).

California [5] grouped records from all cooperating poultrymen for 20 years according to eggs per hen. Flocks averaging over 200 eggs per hen contained 75 per cent pullets and 25 per cent hens. Rate of production made up for smaller flocks and resulted in a higher farm income.*

Table 19 shows the records of all cooperating poultrymen from 1929 to 1948, inclusive, arranged in order of eggs laid per hen per year. A

Table 19

Number of Eggs per Hen	*Number of Records*	*Average* * *Number of Hens in Flock*	*Percentage of Pullets*	*Percentage Mortality and Losses*	*Man-Hours per Hen*	*Farm Income per Hen*	*Total Farm Income per Ranch*
200 eggs and over	40	1068	75.0	17.2	3.0	$3.16	$3375
175–200 eggs	83	1382	61.6	22.0	2.7	1.99	2750
150–175 eggs	150	1396	52.8	25.7	2.5	1.51	2108
125–150 eggs	115	1416	45.0	32.0	2.3	0.81	1147
Less than 125 eggs	32	1608	37.4	37.5	1.8	0.34	567

* Even with larger flock, the total ranch income decreases as egg production decreases.

* Farm income is the amount available to reimburse the operator for his time and managerial ability and the interest on the capital invested.

decreasing production is accompanied by fewer pullets. The increased size of flock did not offset the lower production.

Managing Second-Year Layers

There are at least two methods of handling layers to be held over into their second year of production. First, permit the flock to continue through the winter under lights and be handled as layers continuously. Such a flock will continue production at a slower rate for 3 to 4 months before resuming production at the normal rate. Occasionally such a flock may never entirely recuperate. Second, force the flock out of production in late October or early November. "Turn off the lights abruptly. Take the mash away. Give no water for one day. As soon as production has stopped and the birds are molting, feed grain and mash in the usual manner. Four to six weeks from the time production ceased, give artificial illumination in the usual manner. The new plumage should then be well started." [8]

Table 20 shows production records of three New York State flocks of White Leghorns. Two flocks were given a forced rest, one 40 days and the other 50 days, between the time when lights were removed and again added; the third was not given a forced rest. This third flock was continued in production and held in production through its entire second year of laying and until sold on June 18, 1947. Lights were continued through the entire period. The flock was culled through November when all living birds were kept. In March culling was resumed.

Practically all birds will rest and molt sometime. Through the months of December, January, and February about one-third of a flock will be in production and about two-thirds will be resting, the birds alternating one with another.

Since the use of lights is a stimulating factor, individual birds may be urged back into production before the rest is completed. This would usually result in higher production through November and December than would be experienced in a completely rested flock but would make for a generally lower rate during the balance of the year.

An advantage of the "no-rest" method is the higher production during November, when egg prices are still fairly well sustained. However, December may be a low-price month.

Selling during the year *vs.* holding layers for the entire year involves disposing of the layers after they have been producing a few months as against holding the birds until they have completed their laying year. The practice of selling during the year is increasing rapidly in the East and in many instances may be a profitable procedure, espe-

Table 20. Second-Year Production of 3 White Leghorn Flocks, New York State

Flock 1 August 1, 1942–July 31, 1943 (Forced Rest of 50 Days, November 7–December 26)		*Flock 2* August 13, 1947–August 12, 1948 (Forced Rest of 40 Days, November 8–December 19)		*Flock 3* August 14, 1946–June 17, 1947 (Held without Forced Rest)	
Month	*Eggs*	*Month*	*Percentage of Production*	*Month*	*Percentage of Production*
August 1942	8,767	August 13–31, 1947	53.2	August 14–31, 1946	58.5
September	6,868	September	56.9	September	56.1
October	4,979	October	46.2	October	52.2
November	1,885	November	20.1	November	46.7
December	505	December	3.8	December	37.2
January 1943	3,724	January 1948	43.2	January 1947	30.5
February	4,304	February	49.4	February	27.9
March	4,569	March	46.1	March	31.7
April	4,444	April	45.2	April	45.3
May	4,799	May	43.7	May	48.1
June	5,163	June	45.3	June 1–17	37.8
July	4,844	July	43.0		
		August 1–12	42.0		
Total eggs produced	54,851				
Eggs produced, November and December	2,390				
Other 10 months' production	52,461				
Average number of hens	379.2				
Average production			267.7		285.9
(12 months)	144.6	(12 months)	144.7	(11 months)	128.2
(12 months at 10-month rate)	166.0	(12 months at 10-month rate)	164.0	(12 months at 11-month rate)	139.0

cially when poultry meat prices are high during the winter months. It is better adapted to heavy than to light breeds. The layers are sold in the late fall or winter months after the break in egg prices which normally occurs then. According to results on 28 New York State farms, 1946–1947, the practice was less profitable than when the layers were held for the entire year (Table 21).

Table 21. Costs and Returns per Dozen Eggs for Heavy-Breed Flocks Which Kept and Did Not Keep Birds for an Entire Year, 28 New York Farms, 1946–1947 [a, *]

	Flocks Kept Entire Year	*Flocks Sold Out During Year*
Number of farms	16	12
Beginning number of layers	1047	1085
Total man-hours	2116	1190
Man-hours per layer	2.9	2.1
Percentage of large eggs produced	72	51
Percentage of pullets	100	100
Costs		
Depreciation	$0.049	$0.019
Labor	0.097	0.082
Feed	0.312	0.336
Buildings and equipment	0.034	0.046
Other	0.032	0.040
Total	$0.524	$0.523
Returns		
Eggs	$0.525	$0.505
Other	0.008	0.007
Total	$0 533	$0.512
Profit	0.009	−0.011
Return per man-hour	0.661	0.517
Profit on enterprise	123.000	−100.000
Total returns for labor †	1399.000	615.000

* Farms matched for beginning number of layers and percentage of pullets.
† Return per man-hour × Total hours of all labor.

Sixteen flocks kept for the entire year and 12, sold after a few months of lay were used for this comparison. All had about the same number of pullets at the start. All flocks were 100 per cent pullets.

The total costs were about the same in both groups. Flocks sold after a few months of laying did not lay eggs of full size soon enough to realize as high an average egg price as the layers that were held longer. This difference resulted in a loss per dozen of $0.011 in one case and a profit of $0.009 in the other, or a total loss of $100 as against a profit of $123.

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6 · *Season of Hatching*

Research has removed the seasonal barrier for hatching and rearing.

Egg size at start of laying is related to body size.

Birds approaching sexual maturity during the long, warm summer days start laying early in life and lay small eggs as they start.

Birds approaching sexual maturity as days are shortening and becoming cooler start laying later in life and lay larger eggs as they start.

Poultrymen, by proper management, can quite effectively control the egg size desired at any season.

The price spread between pullet and large-size eggs is least from December to June.

The price of large eggs is highest from June to November.

Having pullets laying large eggs from July on is good poultry management.

More than one hatch during the year may smooth the production curve.

The normal hatching and rearing season for birds is spring. It is the time of year when weather conditions permit birds to leave their nests and secure the food required by themselves and their young, and for the young to forage and continue their growth before the hardships of winter. Production of eggs among birds has, over the centuries, been geared to these natural conditions. Poultry is no exception. Spring is the period of heavy egg production and, until the early 1940's, winter was the season of egg shortage. Improvements in the science and art of keeping poultry led to the discovery that the job of propagating the species can be accomplished at other seasons of the year.

Findings in nutrition have directed provision of many requirements formerly obtained only under range conditions. Selection and breeding knowledge has changed the length of the laying period of the domestic fowl. Advances in commercial incubation have removed the need for this job on the individual farm and have made chicks available the year around, although hatching-egg production is largely a matter for the individual farm.

Problems formerly confronting poultrymen are shown in the hatchability records of a New York poultryman in 1918 (Table 22). From March 15 to May 4 hatchability at no time compared with normal results today. Breeding hens provided with inadequate rations were unable to secure needed nutrients from range in March and part of

Table 22. Hatching Record of a New York State Poultryman, 1918 *

Date Set	Number of Eggs	Infertile	Dead Germs 1st Test	Dead Germs 2nd Test	Chicks Hatched	Percentage Hatched of Total Eggs
March 15	527	38	143	95	85	16.1
22	586	39	116	105	150	25.6
28	587	27	41	63	318	54.1
April 1	586	22	45	67	307	52.3
7	585	23	18	41	397	67.8
13	572	25	25	30	430	75.1
19	585	38	26	40	395	67.5
23	584	26	18	24	458	78.4
29	593	14	30	35	442	74.5
May 4	585	19	19	27	459	78.4

* Record obtained through courtesy of F. E. Andrews, Cornell University Department of Poultry Husbandry, May 1950.

April. The loss in eggs was enormous. Breeding for hatchability was in its infancy. Consequently, pullets could not start laying until late in the year, which, coupled with inadequate laying rations, meant a shortage of eggs until well into the new year.

The effect of inadequate breeder nutrition is evident in the number of dead germs at first and second tests of eggs set March 15 and 22. From then on, slightly improved range conditions and more direct sunlight aided the poultryman in his efforts toward flock replacement and better market-egg returns.

The modern poultryman is held to no particular season for hatching and rearing, although spring is still the predominating season and range is the usual method used for rearing.

The relation of season of hatching and resulting performance of the flock to the receipts and prices of eggs, compared with the particular setup under which a poultryman is working, should answer the question concerning which season meets his conditions best.

Size of Eggs vs. Season of Hatching

Spring-hatched pullets (April, May, or June) require more weeks to reach sexual maturity and lay larger eggs at the start of production than pullets hatched earlier. Body growth has continued during the extra growing period, and egg size is related to body size. Furthermore, cooler weather is conducive to larger egg size. Fewer peewees and pullet-size eggs are expected from April- and May-hatched flocks than from earlier hatches.

To illustrate: from a group of chicks hatched February 15, 1946, in New York State, 466 pullets were housed June 28. The first egg was laid July 12. During July, 41 pullets were placed back on range for further development and added to the flock in late August and September. The percentage production from this group of pullets on September 30 was 64. From this pullet flock there were shipped a weekly average of 3 dozen peewees in July, 14 dozen peewees in August, and 6 dozen peewees for each of the first three weeks in September. This flock began laying at 5 months and produced peewee-size eggs through the third week of their seventh month of age. The pullets started laying early in life while they had smaller bodies. They continued to *grow while laying*, and reached pullet- and medium-size eggs at about the same age as an April hatch on the same farm. The influence of warm weather and longer days as the flock approached sexual maturity contributed to the large number of smaller eggs.

A similar number of pullets on the same farm, hatched April 23 of the same year, started production in late October at about 6 months of age. Only 3 dozen peewee-size eggs were shipped.

In 1947 chicks were purchased for the same farm in February and April. A larger number were purchased in February, and, of the entire flock starting to lay that summer, 68 per cent were from February-hatched chicks and 32 per cent from the April hatch. The two hatches produced 224 dozen peewees, of which the February-hatched pullets produced 88 per cent and the April hatch 12 per cent.

April-hatched pullets in the Northeast encounter continually shorter days as they grow older, and this both retards sexual maturity and increases egg size. The difference in length of day between the February and April hatches at the same age may at times be several hours. For the first several months of lay and at equivalent ages the February hatch produced more eggs. Furthermore, the earlier hatch reached medium-to-large egg size while egg prices were high. The April hatch reached production on the seasonal price decline and in time for the low winter egg prices. The relation of season of hatch to prices of eggs is shown in Fig. 33*A*. Counting from the date of first egg, any difference in annual egg production is not likely to be associated with season of hatching Indications are that profit and return per man-hour are higher with earlier-hatched flocks.

Watson [1] found, "In comparison with flocks of other hatching periods, a larger proportion of the production of early hatched birds was pullet and peewee eggs." In 115 Maine laying flocks the percentage of total egg production by size of eggs was found for each hatching period. See Table 23

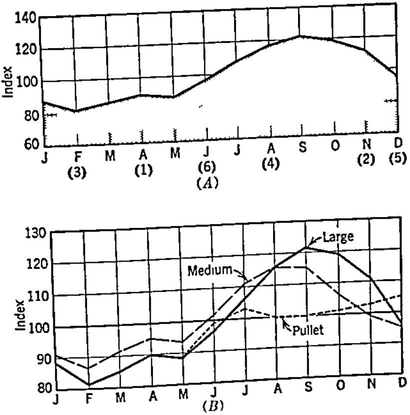

Fig. 33*A*. Effect of season of hatch on price received for eggs Index of seasonal variation of price for best large white eggs at New York City, 1917–1919. The February hatch (3) was in heavy production in August (4) at 6 months of age. The April hatch (1) reached heavy production in November at 7 months (2). The December hatch (5) also took 6 months to arrive at full production (6). Numbers (4), (2), and (6) indicate the approximate price of eggs when February, April, and December pullets, respectively, are commencing their flush production or their first 6 months of lay. *B*. Index of seasonal variation of the wholesale price for large-, medium-, and pullet-size eggs at New York City, 1917–1919. Prices for medium and large eggs vary seasonally much more than prices for pullet eggs. Hatching may be planned to capitalize on this situation.

Three years' results in New Jersey[2] showed a higher percentage of pullet and peewee eggs from birds that reached sexual maturity earliest, i.e., the November 1 and January 15 hatches. Although production was not high, it will be seen that the percentage of small and large eggs

Table 23

	Large *	*Medium*	*Pullet*	*Peewee*	*Total*
Early (October–February)	69.8	22.1	6.9	1.2	100
Spring (March–April)	80.9	15.0	3.7	0.4	100
Late (May–September)	83.1	14.0	2.3	0.2	100
Combination (October–April)	82.9	14.2	2.7	0.2	100

* Includes jumbo, extra-large, and large eggs.

was related to the age when the first egg was laid. April, June, and September hatches require more days to reach sexual maturity and lay fewer peewees. See Table 24.

Table 24

Hatch	*Age at Laying of First Egg (Days)*	*Number of Eggs* *	*Percentage of Eggs Laid*			
			Peewee	*Pullet*	*Medium*	*Large*
June 15	188	166	2	8	48	42
September 1	187	149	7	13	42	38
November 1	170	140	11	14	32	43
January 15	176	150	11	11	31	47
April 1	186	172	4	7	34	55

* Hen-day basis

Gooding in South Carolina[3] asked record keepers to report the hatching dates of their pullets from 1935 through 1946. Grouping these results under February and earlier, March, and April and later, he found that the earlier hatched birds gave slightly higher production, with higher costs and higher labor income. Both number and size of flocks in the earlier hatched group were smaller. See Table 25.

Table 25

Date of Hatch	*Eggs per Layer*	*Number of Flocks*	*Average Number of Layers*	*Feed Cost per Layer*	*Invest-ment per Layer*	*Other Expense per Layer*	*Labor Income per Layer*
February and earlier	155	33	119	$3.92	$4 37	$0.75	$2.95
March	154	223	165	2.74	2.82	0.52	1.92
April and later	148	161	192	2 43	2.51	0.48	1.65

Seasonal Egg-Price Differentials

It has been shown that prices of large eggs are highest in the summer and fall months and lowest in winter and spring. The same situation is likely to apply to medium eggs. Brown egg price ranges are similar. Pullet and peewee prices vary but little.

During summer and fall the differential between pullet-size and large-size eggs is greatest. From a dollar and cents standpoint, fewer pullet-size and more large-size eggs at that time should be an advantage. During fall the price difference between medium and large is greatest, whereas in summer, winter, and spring it is less pronounced.

Spring or even winter may be a logical time to have pullet-size eggs produced and sold. Likewise it may be good business to hatch at such time that most medium-size eggs will have been produced before summer and certainly before fall.

A study of 55 New York State farms[4] by C. D. Kearl, 1946–1947, showing the prices received by seasons, in cents per dozen, is summarized in Table 26.

Table 26

Size	*Fall (September–November)*	*Winter (December–February)*	*Spring (March–May)*	*Summer (June–August)*	*Year*
		White Eggs			
Large	64.8	52.2	53.4	63.4	57.2
Medium	50.8	45.1	47.4	55.0	49.5
Pullet	40.5	38.5	40.4	43.1	40.4
Peewee	30.8	34.0	—	30.9	31.0
		Brown Eggs			
Large	57.5	50.6	53.4	61.3	54.5
Medium	47.8	42.1	45.9	52.2	46.5
Pullet	36.9	34.9	39.8	42.6	37.5
Peewee	31.3	28.5	28.5	29.0	29.3

Relation of Season of Hatch to Egg Prices

Pullets reach egg production at various ages, depending on the season hatched. This may have a bearing on prices received for eggs. Figure 33*A* shows the probable result in prices received from large eggs laid by pullets hatched in February, April, and December.

February pullets should mature sexually during the fifth month and be laying well in August. Large-egg prices are rising rapidly toward their peak at that time. A considerable number of small eggs are produced by these pullets during August and September. The flock should realize a considerable income for large eggs during October and November, and before prices drop severely.

April pullets, requiring longer to mature sexually, should be laying well in November, will start laying larger eggs, lay heavily during the spring season of low prices, and lay practically all large eggs the following summer and fall. Several months will have elapsed before high prices will be realized from this hatch. In the meantime, some mortality and culling may have occurred.

December pullets will be laying well in June. During their early production, prices received for pullet and medium eggs from such a flock should be higher relative to large eggs than if the pullet and medium eggs had been laid during the fall months. A proportionately larger number of smaller-size eggs may be laid by the December than by the April hatch as they approach heavy production during warm weather. By middle summer and fall, this December-hatched flock should be laying mostly large eggs, when the price differential between

large and smaller sizes is greatest. Figures 34–38 show comparisons between December- and February-hatched flocks. Returns for eggs are likely, therefore, to be higher, and costs, although greater, are proportionately less so, resulting in more profit and a better return for labor.

The figures that follow are from two flocks reared on the same farm in New York State, one hatched in February 1949 and the other in December 1949. Both flocks started laying at 5 months, although the December-hatched pullets developed somewhat earlier than the February group. Since the February pullets started laying in July 1949 and the December pullets in May 1950, seasonal differences may have had an effect. During the winter of 1950–1951 difficulties with the water system on this farm developed, and the December-hatched birds were without a constant water supply for indefinite periods. Some molting resulted, and the flock was culled less vigorously than otherwise would have been the case.

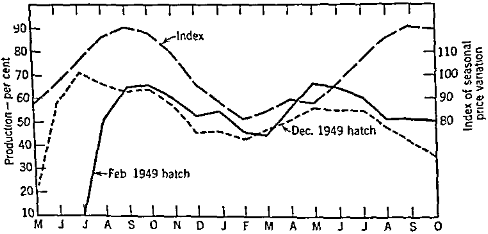

Fig. 34. Index of seasonal variation of the wholesale price of large white eggs at New York City, 1947–1949, and comparison of percentage production of two flocks of pullets on same farm in New York State, hatched February and December 1949

Whatever advantage accrued was mainly due to relation of production to price since the same price per dozen was used for similar months in the calculations, even though different years were involved.

Figure 34 shows the relation of production to the price index of both December- and February-hatched pullets. The production curve follows a very similar pattern, as shown in Fig. 46. The earlier start of the December pullets appears to have been an advantage. Coming into production during a cool time of the year and during lengthening days, they laid 33 dozen fewer peewee eggs, 16 dozen more pullet-size eggs

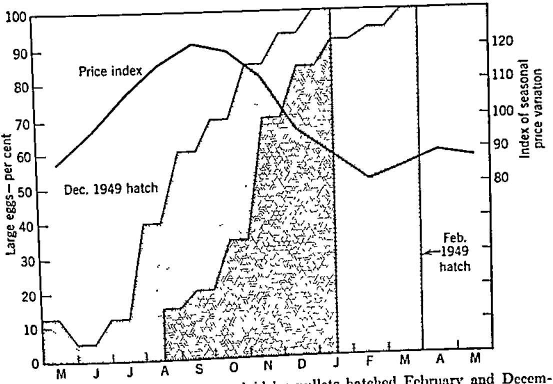

Fig. 35. Percentage of large eggs laid by pullets hatched February and December 1949, in comparison with the index of seasonal variation of the price of large whites at New York City, 1947–1949.

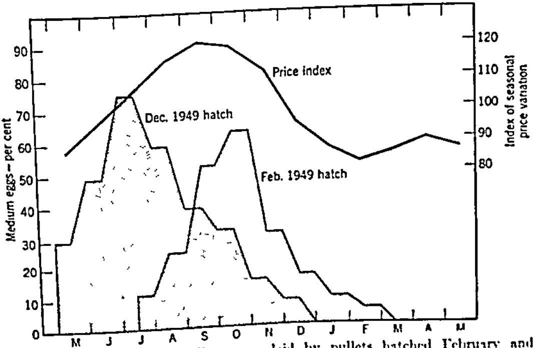

Fig. 36. Percentage of medium eggs laid by pullets hatched February and December 1949, in comparison with the index of seasonal variation of the price of large white eggs at New York City, 1947–1949.

and 156 dozen more medium eggs per 100 layers. After 16 months of laying the average production per bird for the December- and February-hatched pullets was 261.7 and 262.4, respectively, for the entire period.

The December hatch laid 79 dozen more eggs from July to June, inclusive, than the February hatch. The increased value of all eggs for those 12 months, was $88 per 100 December-hatched pullets.

From May the first year through June the second year, the December

Table 27. Comparison of December 1949 and February 1949 Hatches per 100 Layers

	Dozens Laid		Value	
Month	*December Hatch*	*February Hatch*	*December Hatch*	*February Hatch*
May	59		16.05	
June	144		45.44	
July	186	24	63.20	7.26
August	173	135	111.83	62.76
September	159	162	109.51	90.99
October	169	174	96.98	86.86
November	146	153	82.18	81.99
December	120	137	54.70	60.38
January	122	143	61.71	72.60
February	100	108	45.54	49.53
March	121	115	60.50	57.50
April	129	143	71.60	79.92
May	147	174	52.18	61.77
June	139	164	61.85	72.53
Production and value of eggs, July to June (inclusive)				
Totals	1711	1632	871.78	784.09
Difference	79		87.69	
Gain to June 30				
Totals	1914		933.27	
Difference	282		149.18	
Gain to August 31				
July	141	158	63.45	71.10
August	126	135	95.76	102.60
Totals	2181	1925	1092.48	957.79
Difference	256		134.69	
Results to October 31				
September	102	130	78.03	99.45
October	93	132	59 52	84.48
Totals	2376	2187	1230.03	1141.72
Difference	189		87.31	

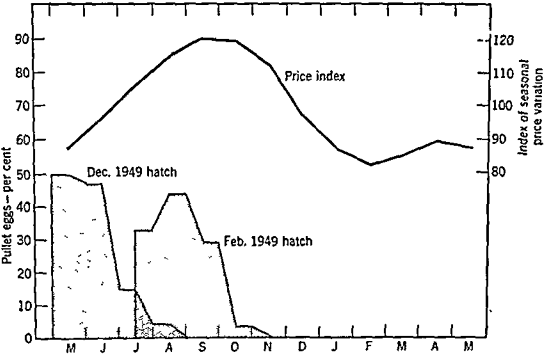

Fig. 37. Percentage of pullet eggs laid by pullets hatched February and December 1949, in comparison with the index of seasonal variation of the price of large whites at New York City, 1947–1949.

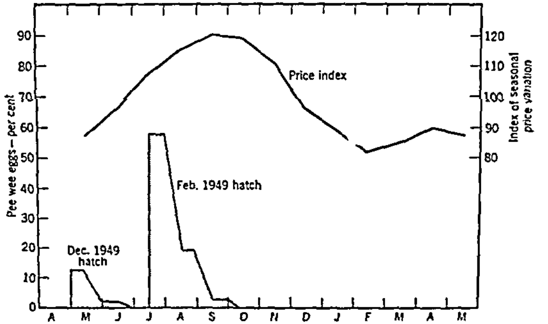

Fig. 38. Percentage of peewee eggs laid by pullets hatched February and December 1949, in comparison with the index of seasonal variation of the price of large whites at New York City, 1947–1949.

birds with 2 extra months were ahead 282 dozen eggs per 100 pullets and showed an increased return of \$149.00.

By August 31 of the second calendar year the December pullets were ahead 256 dozen and \$135.00. See Table 27.

Thus the 2 months at the start of the December pullets' laying performance plus the price advantage during the period July to December appears to be worth considering from the dollars and cents standpoint.

Relation of Season of Hatching to Costs and Returns

Kearl[4] reports, in a survey of 45 farms, 23 of which secured chicks in January and February (winter) and 22 in March, April, and May (spring), an average production, respectively, of 176 and 175 eggs, profits of \$0.08 and \$0.028 per dozen, and returns per man-hour of \$1.19 and \$0.62 (Table 28).

Table 28. Annual Costs and Returns for Farms that Started Chicks Early and Late, Light Breeds, 45 New York Farms, 1946–1947

	Early (January, February)	*Late (March, April, May)*
Number of farms	23	22
Average number of layers	1256	791
Eggs produced per layer	176	175
Percentage mortality	16	17
Pounds of feed per dozen eggs	7.1	7.4
Minutes of labor per dozen eggs	7.9	9.5
Cost per hundred pounds of feed	\$4.28	\$4.48
Costs per dozen		
Labor	0.085	0.103
Feed	0 297	0.306
Other	0.091	0.102
Total	0.473	0.511
Returns per dozen	0.553	0.539
Profit per dozen	0 080	0.028
Return per man-hour	1.19	0.62

The results of a survey in Indiana in 1946 are shown in Table 29. Each group contained both Leghorn and heavy-breed birds.

Table 29

	Time of Hatch		
	Before April	*April*	*After May 1*
Number of flocks	70	20	10
Average number of hens	159	155	131
Eggs per hen	158	151	158
Labor returns per hour	\$0.45	\$0.32	\$−0.02
Labor returns per 100 hens	\$0.94	\$0.74	\$−0.08

The General Egg-Production Pattern

When a large number of birds and poultry farms are involved there is a tendency for the annual production per bird and the eggs per bird

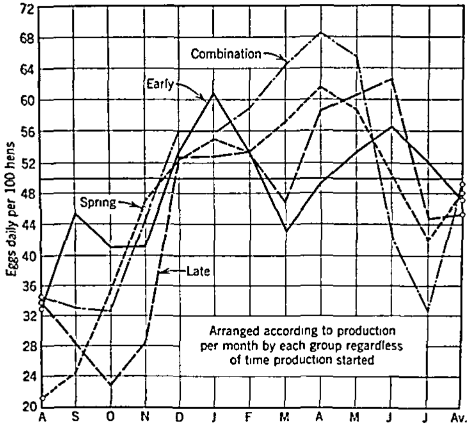

Fig. 39. Daily egg production per hundred laying birds, by months, compared with date of hatch. Many flocks comprising large numbers of layers, and regardless of the season of hatching, show combined monthly production approximating the receipts of eggs on the major markets. (*Adapted from Maine Agr. Expt. Sta. Bull. 462, December 1948, A E. Watson* Results of personal interviews with 115 poultrymen in the more important poultry-producing areas of Maine.)

	Average Production per Bird	*Number of Flocks*	*Layers per Flock*
Early: October–February	173	13	572
Spring: March–April	169	62	393
Late: May–September	165	33	385
Combination: October–April	174	7	605

each month to assume a similar pattern, even though the season of hatching is widely different (Fig. 39). Production on the farms of 115 Maine poultrymen shows a difference of only 9 eggs between the highest and lowest groups of the seasonal hatching periods. Furthermore, the

A New York State Poultry Flock Combination Hatches, February and April

PRODUCTION, MORTALITY, CULLING, AND FEEDING RECORD

August 1, 1941–July 31, 1942

495 pullets (Feb. 24th hatch) placed in laying house June 21 and 22, 1941 at 17 weeks to release range for a second flock.
496 pullets (Apr. 14th hatch) housed during August to November.
Total of 991 pullets housed. 20 of these were sold, leaving 876 in one pen, and 95 late maturing pullets in a second pen.

1941–1942	Birds 1st of Month	Apr. 14th Hatch Added	Dead	Culled	Sold	Production	Per Cent	Eggs per Bird
Aug. 1	475	2	7 (3 P.O.*)	—	5	8,125	56	17
Sept. 1	465	236	11 (4 P.O.)	—	—	9,144	53	16
Oct. 1	690	136	11 (3 P.O.)	—	—	12,738	55	17
Nov. 1	815	122	14 (2 P.O.)	4	—	17,156	66	20
Dec. 1	919	—	15 (6 P.O.)	—	—	17,839	63	20
Jan. 1	904	—	19 (3 P.O.)	1	—	15,143	55	17
Feb. 1	884	—	12 (2 P.O.)	2	—	12,851	52	15
Mar. 1	870	—	11 (4 P.O.)	—	—	13,784	51	16
Apr. 1	859	—	16 (5 P.O.)	44	—	13,223	53	16
May 1	799	—	18 (10 P.O.)	22	—	14,133	59	18
June 1	759	—	11 (2 P.O.)	49	—	12,237	56	17
July 1	699	—	13 (1 P.O.)	35	—	11,686	56	17
Aug. 1	651	—						
			158 (45 P.O.)	157		158,059		

* Pickouts All pickouts found dead in the pen or removed and killed were used.

Mortality	971 birds started		158 dead = 16%
Culled	971 birds started		157 culled = 16%
Ave. number birds (13 figure ave.)		753	
Ave. prod. per bird		210	

Feeding:

1. Free choice grain and mash, fed in double-deck hoppers, grain below, and mash above.
2. No attempt to restrict grain at any time.
3. Water given on mash for several days of real cold weather, and frequently during the summer.
4. Grain and mash per bird 105.4 lb.
5. Total grain fed 51,200 lb. Per cent of total grain and mash 64.
6. Total mash fed 28,200 lb. Per cent of total grain and mash 36.
7. Pounds feed per dozen eggs produced 6.02.
8. Grain fed.

Whole corn	35,800 lb	
Whole oats	11,100 lb	
Wheat	4,300 lb.	(4000 lb. federal wheat purchased in Feb., 300 lb wheat purchased in May.)

9. All-night lights (15-watt bulbs) used year around

Fig. 40

production above and below the 50 per cent line is fairly constant and in this instance is lowest in summer and fall and highest in winter and spring, thereby duplicating the general results throughout the United States. Individual poultrymen can change this situation.

In 1922 Card [6] compared pullets from chicks hatched each month of the year. He observed a tendency for layers to rest and molt during

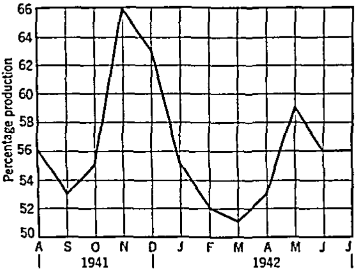

Fig. 41. Percentage production on a New York State commercial market egg farm. Combination flock· Single-Comb White Leghorn chicks; 495 hatched February 1941; 496 hatched April 1941 The influence of the April-hatched flock is evidenced by the November production.

August–July	
Mortality of layers (158)	16%
Culled layers (157)	16%
Average layers (all in one flock)	753
Average production per bird	210

the winter months regardless of season of hatch. At that time conditions prevailed which made eggs scarce on the markets in winter. Card decided that climatic conditions are of major importance. Knowledge of nutrition was less exact than it later became, and breeding and selection practices had shown their effects in only a limited way. Upp [7] in 1927 found summer- and fall-hatched birds gave lower production and higher mortality. Berry [8] in the same year hatched each month, February to November. He showed that chicks hatched February to June gave best results. Jeffrey and Platt [2] hatched chicks five times during the year: June 15, September 1, November 1, January 15, and April 1. Similar conclusions were reached in performance through the year, and in higher relative profits for June and April hatches.

A New York State Poultry Flock Combination Hatches, February and April

PRODUCTION, MORTALITY, CULLING, AND FEEDING RECORD

August 1, 1947–July 31, 1948, plus 2 more months—August and September 1948

Month	*Birds 1st of Month*	*Ave. No Hens*	*Total Prod.*	*% Prod.*	*Returned to Range*	*Pullets Added*	*Mort.*	*Pickouts (incl. in Mortality)*	*Culled*
1947									
July—Started July 9 669 eggs laid July 9 to 31 incl.									
ug.	530	586	13,154	72 4	—	116	5	(1)	—
Sept.	641	620	13,166	70 8	23	—	15	(2)	4
Oct.	599	652	14,751	73	—	119	13	(1)	1
Nov.	704	788	15,780	66.8	—	182	13	(1)	—
Dec.	873	866	17,919	66 7	—	10	16	(1)	9
1948									
Jan.	858	848	16,678	63.4	—	—	4	—	17
Feb.	837	811	13,942	59.3	—	—	11	—	41
Mar.	785	764	14,049	59.3	—	—	5	—	36
Apr.	744	729	13,853	63.3	—	—	9	—	21
May	714	700	13,906	64	—	—	7	(1)	21
June	686	671	12,797	63 6	—	—	8	—	22
July	656	644	12,121	60.7	—	—	3	—	22
Ave. hens		712.2	172,116				109		194

Pullets were debeaked as housed Three got away and a few did not have enough of the beak removed.

Mortality	957 birds started		109 dead = 11.4%
Culled	957 birds started		194 culled = 20.3%
Ave. number birds (13 figure ave.)		712 2	
Ave. prod per bird		241.7	

Aug	631	624	10,813	55 9	—	—	5	—	10
Sept.	616	607	9,179	50.4	—	—	4	—	14

732 chicks (sexed pullets). Feb. 17, 1947. Brooded under one oil brooder in 25′ x 25′ pen.

313 chicks (sexed pullets) Apr 24, 1947. Same brooder.

Free choice grain and mash from 4 wks on. Raccoons took some range birds. Free choice grain and mash fed in double-deck hoppers, grain below, mash above in the laying house. Shell and grit available. Few hoppers of extra salt. No attempt to restrict grain at any time

January a continuous intensively cold month.

Water on mash daily before 8.30 A.M.

Curtain-front house Automatic water supply, heating cable protected.

All-night lights (15-watt bulbs) year around

4 different families cared for the flock. Two of the families with no previous experience

1 pint of 3000 A and 400 D oil was given to each 300–500 lb. of grain as bags were emptied into a bin, during winter and late summer.

Whole corn, wheat, barley and oats for grain with corn or wheat predominating, depending on cost.

Fig 42.

In Fig. 44 the writer has attempted to tabulate the percentage production of each hatch in the New Jersey data into similar periods and by simple "arithmetic average" arrive at a figure approximating the combined percentage lay. Note the high spring and low summer, fall, and winter production. The hatches were spread over 1936 to 1939.

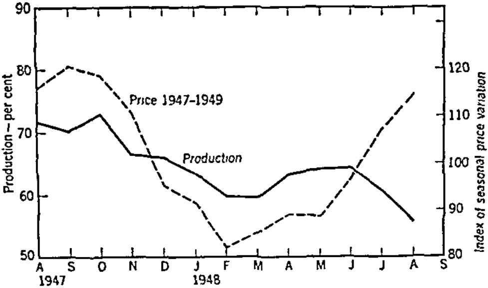

Fig. 43. Percentage production on a New York State commercial market egg farm. Combination flock; the late-winter hatch: Single-Comb White Leghorn chicks; 732 hatched February 1947; 313 hatched April 1947. Production dropped below 60 per cent twice during 12 months; for 14 months production was above 50 per cent. Production is figured on the 13-month average basis. Production began July 9—669 eggs laid July 9-31.

August 1947–July 1948	
Mortality of layers (109)	11.4%
Culled layers (194)	20.3%
Average layers (all in one flock)	712
Average production per bird	211.7

Conclusions were that spring-hatched pullets were, on the average, superior in annual egg production and in production of large eggs.

Since these years advances in nutrition and management practices have combined to increase the average production of many flocks, and annual production is likely to be similar, regardless of the time hatched. Many factors enter into making the final decision concerning the season when chicks should be purchased. In the last analysis the deciding factor may be one of convenience, or the value of poultry meat at certain seasons or, in other cases, the farm setup which may determine how the new pullet flock can be housed without too great loss of large eggs from the old birds occupying the laying quarters at that time. The dovetailing of these events may be more important financially

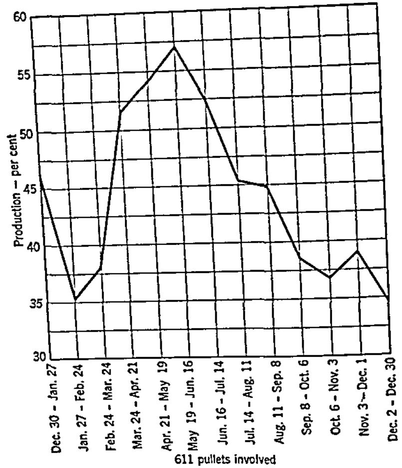

Fig. 44. Relation of date of hatch and percentage production of Single-Comb White Leghorns grouped according to production in any similar 4-week period and regardless of date of hatch or year. Many flocks of layers, regardless of season hatched, drop in production as winter approaches Chicks hatched June 15, September 1, November 1, January 15, and April 1 (*Adapted from Poultry Sci.*, January 1941, *F. P Jeffrey.*)

than the season of hatch. A proper balance between the two should be attempted.

The Spring Hatch

The possibilities in a spring-hatched flock are shown by Scoville[9] on a New York State farm for 1947. The farm combined a high rate of production with other efficiency factors. The trend of production followed that of most laying flocks, reaching the peak of production within a few months after laying commenced, followed by a gradual drop to the end of the 12 months of lay. The spring-hatched flock reached its peak of production while prices were still fairly high and approached its lowest production as the price for large eggs rose and neared the peak.

On this well-managed flock, a very high production during the low-price period resulted in an excellent return through those months. Also, the extra price for large eggs from June to September, even at a much lower production, helped maintain an annual price per dozen eggs produced of $0.55. Figure 45 shows a common price problem with spring-hatched flocks in that the production curve is likely to be the reverse of the egg-price curve.

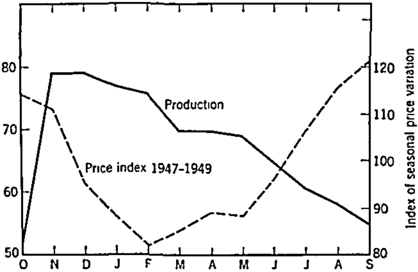

Fig. 45. Relation of index of seasonal price variation, 1947–1949, to the monthly percentage production by a New York State White Leghorn spring-hatched pullet flock (hatched April 13, 1946).

Average number of layers	2025
Average production per year	247 eggs
Average production per year	68%
Average price per dozen eggs	$0.55

The spring-hatched flock, under proper management, may go through the first winter with little, if any, molt.

The Late Winter Hatch

As previously mentioned, pullets hatched in January or February should be laying many large eggs during the period of high prices, although more small eggs are likely during the early weeks of laying. The pullets normally start laying in June or July and lay well during the high-price period.

A small percentage of the hens that lay several months before cold weather sets in may rest for a few days or several weeks and molt partially or completely. These should be culled, assuming management practices are not at fault, and providing a later hatch is coming into

production about that time. Compare "Culled" columns, Figs. 40 and 42.

Many poultrymen, therefore, in the effort to maintain high production throughout the first year of laying use combination hatches as, for example, is shown in Figs. 42 and 43. Late winter and spring hatches were combined in this flock. About two-thirds of the pullets were late-winter hatched and should, therefore, have been in good production by

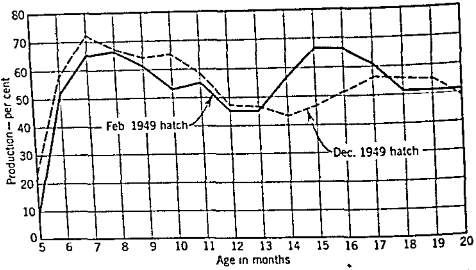

Fig 46. Percentage production by months of February- and December-hatched pullets at the same age Pullets hatched February 1949 began laying July 1949 Pullets hatched December 1949 began laying May 1950.

August. One-third were spring hatched, for full production by November, and this flock checked the downward trend presumably starting about that time in the February hatch. The percentage production of this flock for 12 months from August 1, 1947, was above 59 per cent. The layers were housed in one flock. The production, based on the average number of individuals in the flock, was 241.7.

The details of management are shown in Fig. 42. Detailed results with a second combination flock is shown in Fig. 40. This flock had equal numbers of pullets for starting production in August and November. The production in November was similar for both flocks (Figs. 41 and 43). The average production of the flock shown in Fig. 40 was 210 eggs.

The Late Fall Hatch

Chicks hatched in November or early December should be laying well in May and June, and by summer and fall produce eggs of highest money value (Figs. 34–35). Drs. L. B. Darrah and C. D. Kearl of

Cornell University have taken a poultry farm which housed birds in August and have estimated the results if on this farm the chicks were started in November and the pullets housed in April (Table 30).

Table 30. Effect of Changing Time of Housing Pullets on Laying-Flock Profits of Part-Time Farmer with Light-Breed Flock

	1946–1947 Operation (Pullets Housed in August)	*Suggested Operation (Pullets Housed in April)*
Average number of layers	960	960
Percentage mortality	22	22
Eggs produced per layer	188	188
Costs		
Depreciation	$1046	$1133
Labor	564	564
Feed	4079	4163
Buildings and equipment	384	384
Other	442	442
Total	6515	6686
Returns from eggs	8129	8463
Profit	1614	1777
Return for labor	2178	2341
Return per man-hour	2.39	2.57

Starting chicks in late fall (November or December)

Requires:

Confinement rearing.
Permanent brooding houses.
Possible longer use of heat.
More care to encourage roosting.
Availability of quality of chick desired for future layers.
More labor than usual during summer because more eggs are laid then.
Room to keep both older layers and pullets after pullets reach sexual maturity, as it may be unwise financially to dispose of many layers just coming into their second summer of production.

Provides:

Opportunity to increase returns and also profits—10 per cent or better.
Pullets in production during seasonal price rise.
High production of large eggs during summer and fall months (June–November).
Small eggs produced when differential between large and small is lowest.

Year-Around Hatching

Year-around hatching *requires confinement rearing part of the time* and needs to be planned against expected mortality and culling in any

particular flock. Figure 47 shows the average production in eggs received from Leghorn pullets on a Pennsylvania farm in 1937–1938, which hatched four times each year, January, May, July, and November. The same Pennsylvania farm hatched Barred Plymouth Rocks in

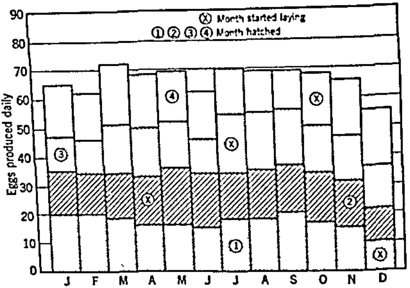

Fig. 47. Eggs laid daily each month by White Leghorn pullets hatched on a Pennsylvania farm, 1938. Averages shown for 1 pullet each hatch and for the 4 pullets combined. Production was consistently high through the year, dropping to 62 eggs per month twice and to 55 eggs in December. 65 eggs were produced in January by each 4 pullets of these combined hatches. Combining the eggs laid per bird for each month on this farm gave a uniform production through the year. Those hatched in July (1) started laying in December and laid 20 eggs each in January. The November-hatched pullets (2) started laying in April and produced 15 eggs each the next January. Likewise, the January hatch (3) laid 12 eggs each the next January, and the May (4) pullets 18 eggs.

	July Hatch	*November Hatch*	*January Hatch*	*May Hatch*
January	20	15	12	18
February	20	14	12	16
March	18	16	17	20
April	16	17 *	18	18
May	16	20	16	17
June	15	19	12	16
July	18	16	20 *	16
August	18	17	20	14
September	20 } 52	17 } 50	19 } 51	13 } 50
October	17	17	16	18 *
November	15	16	16	19
December	10 *	12	14	19
Total	203	196	192	204

* Pullets started laying.

November and February. The eggs laid each month are shown in Table 31.

A basic reason for hatching throughout the year is to secure a uniform production. If this can be accomplished without loss of eggs per bird

Table 31

	November Hatched	*February Hatched*
January	11	14
February	12	16
March	17	16
April	17	17
May	16 *	16
June	17	15
July	19	15
August	18	15 *
September	15	16
October	13	17
November	13	17
December	8	15
Total	176	189

* Pullets started laying.

annually and during periods of high egg prices, further financial advantages may accrue. It should also give assurance to those who may desire to *time* their business according to the factors of receipts and prices. It appears, however, that desirable results rest with the individual poultryman and not alone with season of hatching.

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7 · Systems of Flock Replacement

There is no one best system of flock replacement. There is likely to be a plan which is better than most others for any particular poultryman. In the United States the tendency toward earlier hatching, together with solutions of the problems involved, appears to be gaining. Such changes, insofar as new management methods are required, occur slowly and may require a generation or more to mature.

Few new methods are adopted quickly unless they involve little physical or mental effort or are so outstanding in their eventual results as to be not debatable. The use of artificial illumination spread rapidly and for good reason. The change from permanent, long-pipe brooder houses in use 40 years ago to the colony-house system and back again has taken, and is taking, time. Much expense and thought have been necessary.

Individual poultrymen move quicker than the great group of poultry keepers generally can hope to, and so may benefit from economic realities and trends of the times.

The system of flock replacement used may depend on:

1. The buildings and equipment available.
2. The labor involved should a change be made.
3. The cost involved should a change be made.
4. Whether an economic reason exists for making a change.
5. The climate.
6. The operation.

The various systems that follow may be used for light or heavy breeds kept for laying purposes. Ordinarily 3 and 4 square feet of floor space is allowed for each light-breed and heavy-breed fowl, respectively.

The systems described are, in most cases, examples in operation on actual farms. The methods apply to flocks of any size and from sideline to commercial enterprises.

The colony-brooding system.
The barracks range-rearing system.
The barracks-confinement system.

The shelter-confinement system.
The two-way brooding and confinement system.
The 12-month laying system.
The cage system.

The Colony-Brooding System

For spring or summer brooding, combined with range rearing, colony brooding works well for small flocks. One should recall that chicks hatched in late April, May, or June will start laying near the end of the calendar year. The flush of their production will come during the low-price egg period. However, such flocks should lay many eggs the summer and fall following, when properly managed, although culling

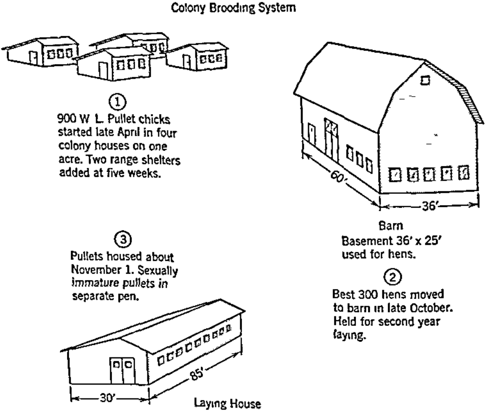


Fig 48.

and mortality will have taken their toll during preceding months. Such a flock is not likely to do so well financially as earlier hatches, but, carefully handled, it should perform satisfactorily and make the most out of late hatches.

Figure 48 shows a plan with a New York State White Leghorn flock

using colony brooders and late hatches. In October the sexually matured pullets are moved into those laying-house pens which have been emptied by culling, mortality, and moving hens to the right toward the end pens. By November the best 300 of the remaining hens are selected and moved to the barn and the balance sold. A few good hens may need to be sacrificed in this last selection. The balance of the range pullets are then moved in. Culling is done at night by flashlight and takes place throughout the year after the pullets are housed.

The poultryman's wife does the brooding and the light work with hens on this dairy and poultry farm.

The features of this plan are that it:

1. Eliminates winter colony brooding.
2. Correlates housing pullets with the disposal of hens.
3. Reduces the brooding period to 5 or 6 weeks.
4. Avoids having to sell all hens to make way for pullets.

For the past 12 years this farm has made a return for each man-hour spent on the laying flock of $1.14 to $2.95. In 3 successive years during the recent favorable price period the flock had an average of 850 layers, an average production of 210 eggs per hen, and an average profit of $2610.[1]

The Barracks Range-Rearing System *

Among the poultrymen who keep heavy-breed layers, some are in favor of hatching early so the pullets will start laying in June or July, culling frequently, and finally disposing of all remaining birds after about 18 months of laying. By that time, November or December of the following year, the remaining birds will be rapidly approaching their molting period. All potential first-laying-year eggs in the flock have been secured.

The barracks range-rearing plan calls for 100 per cent renewal annually with heavy breeds and an example is shown in Fig. 49. In February 1650 Red-Rock Cross pullet chicks are purchased and in March 550. The flock of approximately 2075 pullets is taken to the range during April to June, as weather permits. Sixteen range shelters and 4 acres are ready for them at that time.

In June 700 hens from the laying house are moved to the brooder and the balance (about 600) are moved to the barn basement and held until November or December. (If light breeds are used, the 600 in the barn may be held for a second year's production.) The laying pens are then

* This system may be used for any egg-laying breed.

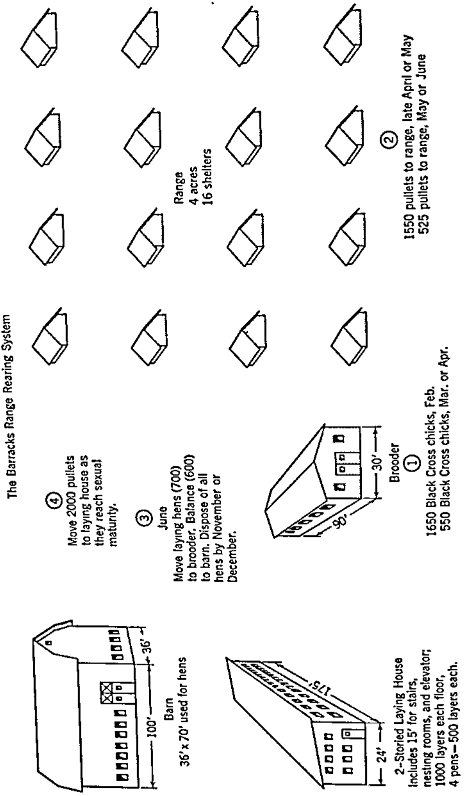

The Barracks Range Rearing System
Barn
36'x 70' used for hens
100'
36'
2-Storied Laying House
Includes 15' for stairs,
nesting rooms, and elevator;
1000 layers each floor,
4 pens—500 layers each.
24'
175'
④
Move 2000 pullets
to laying house as
they reach sexual
maturity.
③
June
Move laying hens (700)
to brooder. Balance (600)
to barn. Dispose of all
hens by November or
December.
90'
30'
Brooder
①
1650 Black Cross chicks, Feb.
550 Black Cross chicks, Mar. or Apr.
Range
4 acres
16 shelters
②
1550 pullets to range, late April or May
525 pullets to range, May or June

Fig. 19.

made ready for the pullets, about 2000 of which are moved in shortly afterwards as they reach sexual maturity.

By July 1 on this farm the number of layers, pullets plus hens, is about 3300. By December the flock will have been reduced by disposal

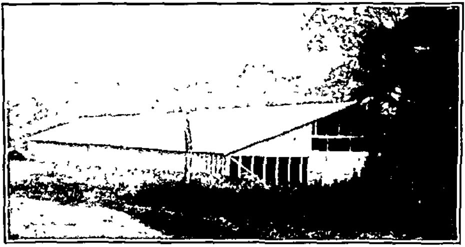


Fig. 50. Laying shelter, 40' x 200', constructed in 1919. Used on a New York State farm producing hatching eggs. Equipped with automatic watering and feeder. Earth floor. New Hampshires were housed during the summer and remained through the winter.

Costs

Gravel	$ 49.15
Cement	208.21
Cinders and chimney block	449.70
Lumber	1517.42
Aluminum roof	1457.85
Nails	54.27
Nests (second hand)	150.00
Hardware cloth	60.00
Electric material	178.15
Miscellaneous	521 35
Lightning rods (grounded)	56 00
Labor	1202.32
Plumbing	137 21
Waterers	54 15
Automatic feeders	640.00
Painting	225 00
Total	$6960.78

of the hens and by the normal mortality and weekly culling among the pullets.

One of the reasons for success is that the permanent brooder serves, after brooding, as a barracks or temporary quarters (July–December) for the hens, which provide the operator with large, high-priced eggs during the summer and fall. The brooder thus avoids congestion at pullet-housing time. Used in this way there is an efficient use of all

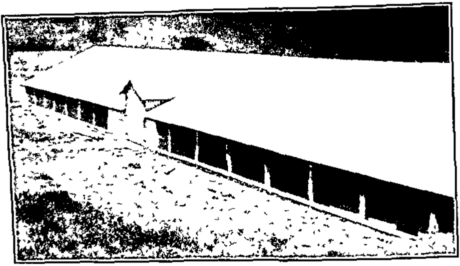


Fig. 51. Laying shelter, 50' x 204', built in 1950 at cash cost of $4500. Two carpenters were used 20½ days. Labor of the operator and hired men is not included Earth floor, supports locust posts driven or sunk 4 feet into the ground. Four nesting rooms, double-deck perches, and feeders were included in the cost. Waterers and lights were extra and were to be installed later. Such a laying shelter may be used to supplement brooder-house accommodations in either the barracks-range rearing or barracks-confinement systems.

Four thousand Leghorns were housed from June to November, inclusive. An average of 2000 layers should produce 1000 eggs daily, or 15,000 dozen eggs at $0.50 per dozen (estimated average price). The gross return in eggs is $7500.

building space, except range shelters, which are used for a few months only.

Reasons for success on this farm are:

1. Permanent brooder house.
2. Ample room at housing time.
3. Greatest number of layers and maximum number of eggs during high prices.
4. Weekly culling of the laying flock.
5. A well-culled laying flock during the spring months to meet rearing costs and running expenses
6. Efficient use of all building space.
7. A uniform distribution of labor throughout the year.

This farm uses the equivalent of 1½ men. Three years' average results (1944–1946) are:[2] average number of layers, 1750; average production per hen, 221 eggs; average labor income, $7027.

For the years 1947–1949 the average number of birds was increased 325. Production per bird and mortality remained about the same. The general price level had improved from an average of 161 in 1944–1946

to 230 in 1947–1949. Prices were, therefore, rising. The farm egg-price index had risen from an average of 159 in 1944–1946 to 218 in 1947–1949. Under these favorable conditions results for 1947 to 1949 inclusive were: average number of layers, 2075; average production per hen, 223 eggs; mortality, 7.8 per cent; average labor income, $12,009.[2]

The Barracks-Confinement System

The confinement system requires house room to care for the pullets until they can be moved to the laying house. Chicks hatched in January, February, or later can be moved from the brooder after 2 to 3 months. The brooder building should provide 1 to 1½ square feet of floor space for each pullet until that time. The amount of time for pullets to spend in the brooder building will depend on:

1. When heat can be discontinued.
2. When the hens can best be moved out of the laying house and into the brooder building or barracks or other quarters.
3. Whether the pullets are beginning to crowd.

An approximate amount of floor space to provide for each pullet varies with the size of the bird and can be estimated.

	Light Breeds	*Heavy Breeds*
3 to 8 weeks	1 sq. ft	1 sq. ft.
8 to 12 weeks	1½ sq ft.	2 sq. ft.
12 to 16 weeks	2 sq. ft	3 sq ft.
16 weeks on	*3 sq. ft.*	*4 sq. ft.*

Figure 52 shows this system, with reuse of built-up litter for layers, averaging 5500 layers, with two buildings, and the laying and brooder houses. The brooder, 40′ x 150′, provides 1⅓ square feet for 4500 light-breed pullet chicks for 10 weeks. When chicks are started in January or February, moving may commence in April and be completed in June.

The laying house has three stories and 6 pens holding 1000 layers each. On January 1 it may contain approximately 4000 pullets from previous January hatch (minus any mortality which has occurred since laying started in June), 1000 hens to be held for a second production year, and one empty pen. In April 1200–1500 pullets are moved to the empty pen. In June, while hens are still in the pens, 3 pens are cleaned of all packed litter areas, the loose built-up litter leveled, and 2000 yearlings moved to the brooder or barracks. A temporary movable

wire partition in the brooder helps accomplish this. The pullets from the brooder are moved into the 3 pens and with those moved in April are distributed evenly among the 4 pens. Immature pullets are separated

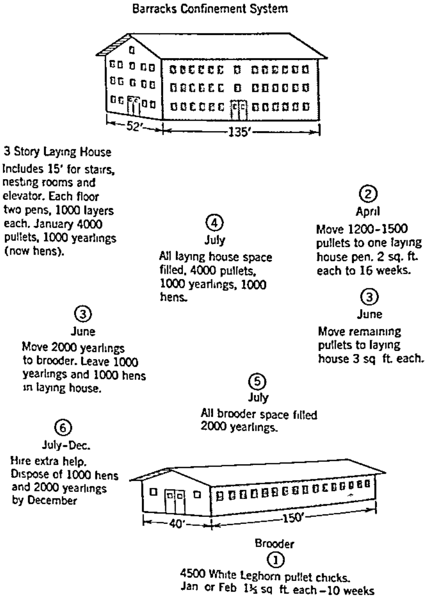


Fig. 52.

from the others by a temporary partition and released as they reach sexual maturity.

The laying house by July thus contains approximately 1000 old pullets or yearlings, the remainder of the 1000 hens held for their second year, and 4000 new pullets. The brooder house has received 2000 yearlings.

From July to December more help is needed to care for the extra eggs. All birds are carefully culled until, by December, the balance of the 1000 second-year hens in the laying house and the yearlings in the brooder have been removed. The brooder is now empty and ready to be cleaned and equipped for the next lot of chicks. The laying house *contains approximately 4000 or more current-season pullets and about* 1000 of the yearlings (now hens) to be carried for a second production year.

Advantages of this plan:

1. Rear regardless of season.
2. Ample room at housing time.
3. Maximum production of eggs during high prices.
4. Efficient use of buildings.
5. Uniform labor load.

The farm is a two-and-a-half-man enterprise.

The plan may be adapted to any season of hatching, varying the months of management accordingly.

The Shelter Confinement System

This system is preferred by some poultrymen, especially when colony brooders and range shelters are on hand from previous range-rearing operations, and confinement rearing for some reason is now deemed desirable. The system appears best adapted to 100 per cent renewal annually. As with the colony system, the rearing buildings and equipment are likely to be used but slightly over one-half of the year, thus resulting in idle capital.

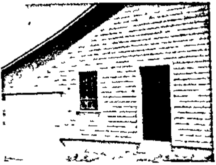
Wire runs are connected to the brooder houses and shelters, and the chicks from each brooder divided, when the proper time arrives, between the brooder house and a shelter.

In the example illustrated in Fig. 53, the chicks are held for 10 days in a battery room, then moved to the brooder houses, and thence, all or some, to the shelters. The brooding season starts April 1, and rearing is completed October 15. On this plant, averaging about 3000 birds, brooders and shelters are approximately 12′ x 12′, and wire platforms 16′ x 20′.

While on range chicks are fed and watered once each two days. Automatic waterers should reduce the time required.

As pullets reach sexual maturity they are housed in pens which have been emptied by culling and mortality until the entire new flock of pullets has replaced the hens.

THE SHELTER CONFINEMENT SYSTEM with BATTERY BROODERS



①

Chicks are held in batteries 10 days.

5000 pullet chicks and 425 cockerels brooded annually. Balance of cockerels killed.

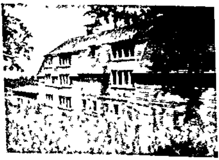
Battery room 17'x 11' warmed with a space heater.

②

36 brooders and range shelters are equipped with 16'x 20' wire platforms. Chicks are transferred through the season, 300 to a 12'x12' brooder.

At 4 weeks access is given to the wire platforms.

At 8–10 weeks the chicks are divided among shelters, 150 each and reared to 20 weeks or to sexual maturity.



③

Pullets housed at sexual maturity in pens available by culling and mortality.

Average size of flock – 3000.

Fig. 53.

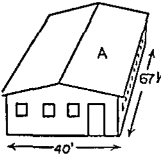
The Two-Way Brooding and Confinement System

A big job in flock replacement is moving pullets from one place to another, either from the brooder to the range and, later, from range to laying house or, if grown in confinement, from where grown to laying quarters. In each case, the flock of laying hens must be moved to the barracks quarters if they are to be kept to complete their first laying year.

THE 2-WAY BROODING AND CONFINEMENT SYSTEM

Layers Left Where Brooded

Plan for 1951 – '52



320 Capacity
Pen B
Optional

① Dec. 1, '50
320 Yearling hens

② Nov. 15, '51 *Hens sold*
Refilled from C

④ Nov. 15, '52 Hens sold
Refilled from A

900 Capacity
Pen A

① Dec. 1, '50. Brood 1000 chicks

③ Dec. 1, '51 Pullet layers

④ Nov. 15, '52 Empty.
Best 320 to B

⑤ Dec. 1, '52. Brood 1000 chicks

900 Capacity
Pen C

① Dec. 1, '50. Pullet layers

② Nov. 15, '51 Empty.
Best 320 moved to B

③ Dec. 1, '51. Brood 1000 chicks

⑤ Dec. 1, '52. Pullet layers

ANNUAL INVENTORY of STOCK on HAND

Dec. 1.	July 1.
1000 Chicks	900 Pullet layers
320 Yearling Hens	300 Hens
800 Pullet layers	700 Yearling Hens
1120	1900

Fig. 54.

Moving birds on many poultry farms, although an interesting job, is expensive in labor and equipment required.

A flock for egg production only may be left through their laying year in the building where brooded and reared to sexual maturity in confinement. As the layers that survive culling and mortality may be held

from 12 to 18 months, chicks may be brooded every other year in the alternate building. Should permanent brooding systems be used, two complete brooding units will be needed. When movable brooding units are employed (coal, oil, electric, gas, or wood) they may be moved each year. Nesting units, feeders, waterers and perches are required in both buildings and are used each year.

The cost of an extra brooding unit, when a permanent one is used, may be partly written off each year by eliminating the labor of moving pullets and hens. Each permanent brooding unit is idle alternate years in this plan.

This plan may be used for 100 per cent flock replacement or another unit used for holding the best quarter or third of the yearlings for their second production year.

Figure 54 shows a poultry-farm layout, averaging about 1500 layers, in New York State, constructed with this idea in mind. The single upstairs pen *C* extends from the right corner over the garage to the far left corner and holds 900 layers.

Pen *B* holds 320 hens.

The front end of pen *A* and a portion of pen *C* are arranged for the necessary brooding space which, with the balance, provides the area needed for rearing the entire lot to sexual maturity in the respective pens. This same area also may house the pullets through their entire first laying year, or a maximum of 18 months.

The buildings may be used for the *barracks-confinement system*, in which case but one brooding unit is needed, and both hens and pullets will require moving.

The 12-Month Laying System

Several variations of this system are described below. In certain sections a fine market for poultry meat prevails during the fall and winter months, and poultrymen with heavy breeds have shown a tendency to build their management plan around it. The plan has several possibilities. In general, it applies to heavy breeds.

1. Figure 55 shows the operation on a farm in New York State. The main enterprise consists of starting 3000 chicks January 15, moving them to the range, then to the laying house in June, where they are kept as layers until December or early January. They are then sold as meat, after they have laid eggs for 5 or 6 months only.

A supplementary enterprise on this farm consists of following the main lot of birds with a second 3000 chicks in April (broken line on chart) and developing them on the same range until September when

they are sold at the high price usually prevailing at that time for heavy pullets.

2. Since the brooder and laying house are empty from June to January, and from January to June, respectively, broilers could be grown for a full year as a second supplementary enterprise.

12 Month Crossbred Laying System

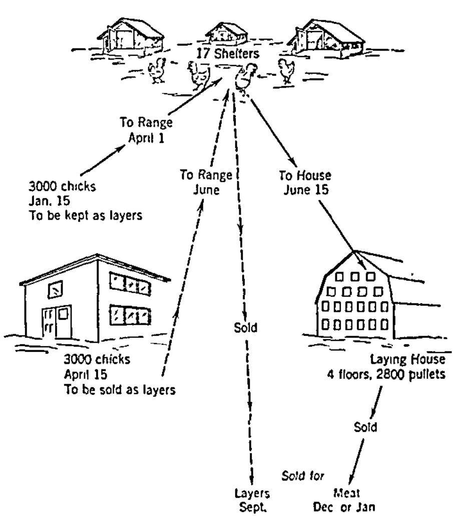
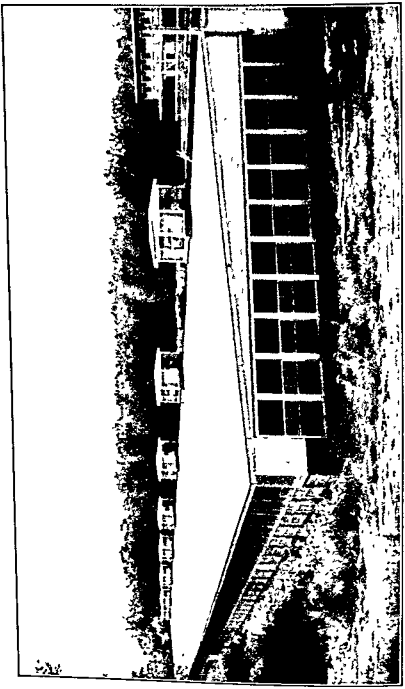


Fig 55

3. This 12-month plan for layers only could be followed by using only a laying house and a range, and brooding in the laying house.

4. Even a range might be eliminated were the chicks to be brooded in the laying house and reared in confinement there.

5. Range can be used entirely. In sections of the country where water freezing does not occur at all or until December or January, the laying house may be eliminated. Chicks are started in December or January



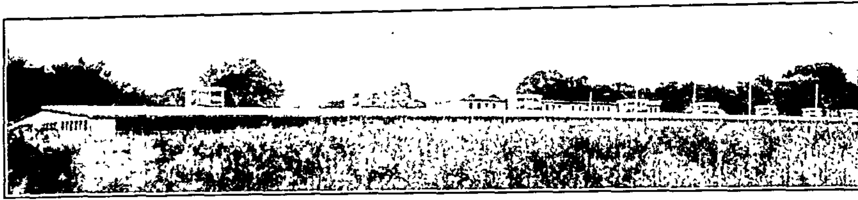


Fig. 56. All-purpose house, 90′ x 500′, single story; used as a complete unit in the 12-month laying system; accommodates 11,250 layers at 4 square feet or 15,000 at 3 square feet. Windows are glass and all are movable. Ventilation is through windows and cupolas in the roof. Cinder blocks comprise the walls halfway up, with frame construction, window frames, and windows the rest of the way. Cost of the house: $0.75 per square foot. Mash and pellets are fed in 6 automatic feeders, each servicing 500 feet, and whey is fed in tubs; 20,000 Red-Rock Cross pullets are purchased in January, brooded under oil brooders, 500 per stove. Layers are sold in December. *(Courtesy Frank Bennett, Wilbraham, Mass.)*

Posts and girts: 6″ x 6″
Slope of roof: 18″ to 30′
Roof construction: Solid roof boards; ¾″ insulation boards; 19″ overlap roofing

Table 32. Results of Hens Housed in Individual Wire Cages Compared with All Other Birds[a]

	Individual Cages								
	1941	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*8-Year Average 1941–1948*
Number of records	4	3	6	4	4	1	3	7	32
Hens in flock	877	1096	944	843	654	598	795	842	831
Eggs per hen	181.1	185.4	181.2	182.2	195.7	169.4	190.2	222.2	188.8
Fall eggs laid	50.6	57.6	55.8	55.5	61.4	62.8	59.6	70.0	59.9
Percentage mortality	39.7	31.5	21.8	20.1	16.1	8.2	23.9	19.9	22.7
Percentage culled	58.2	71.1	93.9	122.9	121.6	121.9	77.4	83.1	93.8
Percentage pullets	63.2	68.3	77.3	77.1	67.5	82.1	67.1	79.1	72.7
Per hen									
Investment	$6.19	$6.02	$7.12	$6.12	$6.28	$7.91	$9.25	$8.77	$7.28
Man-hours	4.0	5.0	3.8	3.2	3.3	2.9	4.9	3.1	3.8
Labor cost	$1.18	$2.34	$1.74	$2.31	$2.47	$2.20	$3.70	$2.34	$2.29
Total cost	5.18	6.62	6.97	7.93	8.83	8.99	12.30	11.69	8.60
Total income	5.37	6.19	8.21	7.29	10.26	8.77	11.18	13.19	8.88
Management income	−0.11	−0.13	1.21	−0.04	1.43	−0.22	−0.82	1.50	0.28
Family and operator labor	0.77	2.06	1.15	2.21	2.41	2.20	3.70	2.10	2.11
Net cost per dozen eggs	0.281	0.356	0.302	0.413	0.385	0.526	0.682	0.523	0.415

	All Other Records								
	1941	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*8-Year Average 1941–1948*
Number of records	35	31	19	16	13	9	12	7	142
Hens in flock	1394	1192	1598	1503	1764	1562	1188	1000	1438
Eggs per hen	107.0	171.7	166.6	171.7	175.3	173.8	185.8	182.8	174.3
Fall eggs laid	47.0	46.7	47.0	48.2	50.1	51.8	55.9	55.0	50.2
Percentage mortality	23.9	22.9	21.2	23.2	22.1	19.6	15.9	19.4	21.4
Percentage culled	51.1	57.2	62.6	75.0	78.6	68.5	81.0	97.7	71.5
Percentage pullets	54.8	59.0	59.0	54.7	55.6	54.4	63.0	71.9	59.1
Per hen:									
Investment	$4.33	$3.66	$3 58	$3.66	$3.51	$5.34	$5.64	$7.49	$4.66
Man-hours	2.8	2.5	2.5	2.4	2.4	2.7	3.1	2.4	2.6
Labor cost	$0.85	$1.17	$1.25	$1.72	$1.80	$2.07	$2.21	$1.81	$1.61
Total cost	3.94	4.65	4.91	6.39	6.26	8.15	9.43	10.33	6.76
Total income	4.60	5.75	6.62	6.38	7.60	7.90	10.57	10.88	7.54
Management income	0.66	1.10	1.71	−0.01	1.34	−0.25	1.14	0.55	0.78
Family and operator labor	0.67	0.93	0.92	1.43	1.41	1.42	1.82	1.57	1.27
Net cost per dozen eggs	0.243	0.277	0.318	0.400	0.371	0.503	0.515	0.543	0.396

8 · The Chick Industry

Farm hatching is decreasing.

Commercial hatcheries increased their output from 1930 to 1949 by nearly 1 billion chicks.

The number of hatcheries is decreasing.

Total egg capacity of all hatcheries is increasing.

Individual hatcheries are increasing in egg capacity.

Size of business is reflected in incubator capacity and in number of times used in a year.

Prices and index of prices for baby chicks have shown an upward trend since the early 1930's.

Purchasing power of chick prices reached a peak in 1944 and 1945.

Producing and selling baby chicks is a lucrative business.

Profit per chick ranged from \$0 035 to \$0 0675 on New York State cost-account farms, 1944–1948.

Returns per man-hour are high in incubation.

As late as 1925 major emphasis was being placed on selection of breeders and operation of small incubators for a vast number of poultry farms which produced their own chicks for flock replacement. As late as 1930, 58 per cent of the chicks hatched were produced on farms, but by 1940 the number was only 27 per cent. See Fig. 58.

This decrease in farm hatching has continued. By 1948 about one-half as many eggs were used for farm hatching as were used in 1940. During this period the total number of eggs used for hatching and the number of eggs set and chicks hatched by commercial hatcheries have increased. During the war years the increase was in commercial hatcheries and not on farms. This trend was still more pronounced in 1949.

Commercial hatching began about 1880. There was scarcely any perceptible advance until 1900. From then until 1918 the increase was gradual, but pronounced. Since 1918 the hatchery industry has advanced to become an important enterprise in the United States. The poultry industry became increasingly more specialized during that period. The commercial hatchery industry has made possible more concentrated effort by market-egg and broiler producers on their particular problems

According to a 1937–1938 survey [3] the East North Central states of Ohio, Indiana, Illinois, Michigan, and Wisconsin had the most hatch-

eries, or 2513. The West North Central states were second with 2414, and the Middle Atlantic states of New York, New Jersey, and Pennsylvania were third with 1326. The South Central was, that year, divided into two regions. They are combined in 1938 to compare with 1943 and 1948 (Table 33).

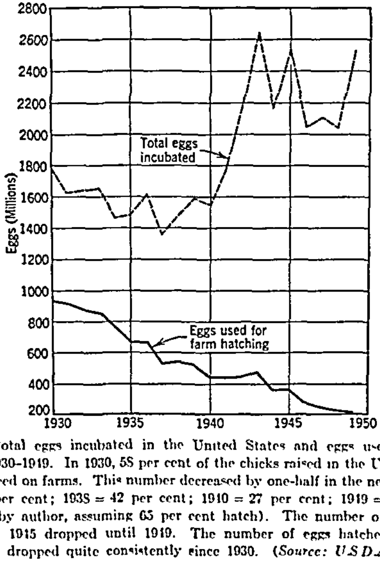


Fig. 58. Total eggs incubated in the United States and eggs used for farm hatching, 1930–1949. In 1930, 58 per cent of the chicks raised in the United States were produced on farms. This number decreased by one-half in the next 10 years: 1931 = 53 per cent; 1938 = 42 per cent; 1940 = 27 per cent; 1949 = 8 per cent (estimates by author, assuming 65 per cent hatch). The number of eggs incubated since 1945 dropped until 1949. The number of eggs hatched on farms has dropped quite consistently since 1930. (*Source: U.S.D.A.*[2])

By 1943 the picture had changed slightly.[4] The West North Central states of Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas led with 2348 hatcheries, and the East North Central states had dropped to 2110 hatcheries and second place. The 1943 tabulation combines the East and West South Central regions into South Central. This was in third place with 1531 hatcheries. However, these eight South Central states had but 156 more hatcheries than the

and moved to range shelters in March or April, or earlier, depending on the particular climatic conditions. Nests, water (preferably automatic), feed, and other necessities for production are provided, and the layers are left on range until marketed, when they are approximately 12 or 13 months old.

A disadvantage of plan 5, depending on market preferences and assuming green range is used, is the actual dark yolk color evident upon breaking an egg into a dish. Confinement during the months of production gives better control over this market-quality factor. The possibilities

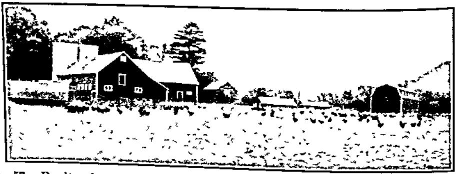


Fig. 57. Poultry barn at right used for brooding, and for laying by the pullets in the foreground. A 1200-layer plant using the 12-month laying system

of the 12-month laying system appear to be numerous, but the ones selected may depend on:

1. The help available.
2. The buildings available.
3. The need for operating funds January to July.
4. The profit in meat production.
5. Market preferences.
6. The effect of climate.

The Cage System

This system of keeping layers has increased in certain sections of the country and decreased in others. In the East it apparently became less popular during the 1940's. In California the expansion of cage housing since 1939 has been phenomenal. Operators on the West Coast figure production per cage rather than per hen. A cage may receive a new occupant 2 to 4 times annually. A record sheet by each cage informs the operator at any time about its occupant. Ordinarily, if the bird falls below 15 eggs per month, she is removed and replaced with a pullet. Factors that can be checked are health, production pauses, and egg quality. Yearly culling and mortality may average 100 to 140 per

cent or more. Consequently, it is general practice to brood every 7 to 8 weeks in order to have replacement pullets when needed to keep the cages filled.

Caged birds are at the mercy of the caretaker and the weather. In California a roof over 2 rows of cages is customary housing. Sprinkling systems are in use for spraying roofs in very warm weather. The cages themselves are clean, but droppings accumulate and attract flies more than in floor-litter housing. Many houses in California are equipped so that night droppings fall outside the house. The fly condition is not improved and is objectionable.

In Los Angeles County 80 per cent of all new housing since 1941 is of cage type. In San Bernardino County many caged birds are exposed to cool winds at night, which is a slight disadvantage. In Orange County a number of large cage ranches are laid out with tree protection from the wind and are apparently very successful.

The variation in costs is considerable in different years (Table 32). The cage group's 8-year average excelled in the favorable factors of production per hen, fall eggs laid per hen, percentage of pullets, and total income per bird. The cage group also exceeded the other records in such factors as mortality, percentage culled, investment charges, man-hours per bird, labor cost, and total cost. The extra income was in extra eggs and in birds sold. Costs of replacement were higher, resulting in a lower management income per layer. Since a good share of the work was done by the family, which worked longer hours and increased the costs, the money available for family use was greater with the caged birds. For birds housed by the floor method the same amount of time on a correspondingly larger number of layers is likely to have worked favorably.

The net cost, including the value of all labor, was higher in the cage groups.

Poultrymen operating individual cages had smaller flocks, and in the 8-year average figures made approximately $1000 less per flock.

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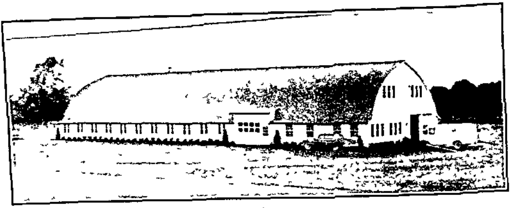

(*A*)

(*B*)

Fig. 59.*A*. A modern hatchery in the Northeast, selling several million chicks annually *B* Incubators in a modern Northeastern hatchery, showing clean, well-lighted quarters deemed essential in the hatchery business in 1950.

three Middle Atlantic states. Under the same regional division as in 1938, the states of New York, New Jersey, and Pennsylvania were still in third place for 1943. The number of hatcheries decreased. The egg capacity increased. The regions showing greatest decline in number of

Table 33. Geographical Distribution of the Hatchery Industry in the United States, 1938, 1943, and 1948 [4]

Regions	*Number of Hatcheries* 1938	1943	1948 *	*Total Egg Capacity (000 omitted)* 1938	1943	1948
West North Central	2,414	2,348	2,234	123,235	165,682	174,897
East North Central	2,513	2,110	1,840	114,903	127,309	127,496
South Central	1,337	1,531	1,466	39,593	58,771	65,618
Middle Atlantic	1,326	1,375	1,224	36,413	45,067	47,509
South Atlantic	810 *	905	927	24,777	48,723	66,470
New England	1,017	843	804	15,799	19,177	26,090
Pacific	876	755	636	33,873	29,500	33,651
Mountain	240	245	210	8,783	10,411	10,113
United States	*10,533*	*10,112*	*9,341*	*397,376*	*501,640*	*551,847*

* District of Columbia included with 2 hatcheries as reported in [3].

hatcheries were East North Central, New England, and Pacific. California showed the largest decline, 109. Illinois was second with 96.

The trend toward fewer but larger hatcheries prevailed in 1948.[5] All regions dropped in numbers of hatcheries except the South Atlantic, where there was a small increase. Total capacities increased in all except the Mountain states of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada, which lost both in hatchery numbers and egg capacity.

Table 34. Egg Capacity and Number of Hatcheries in the United States, 1938 and 1943 [4]

Egg Capacity Group 1943	*Number of Hatcheries* 1938	1943	*Egg Capacity (000 omitted)* 1938	1943
Under 10,000	2,867	2,199	13,673	11,101
Up to 24,999	3,023	2,673	18,131	13,238
Up to 39,999	1,720	1,693	51,108	52,284
Up to 59,999	1,262	1,353	61,124	65,189
Up to 99,999	896	1,176	66,826	87,610
Up to 199,999	541	641	69,816	81,916
Up to 499,999	182	289	52,905	85,184
500,000 and over	40	88	30,703	71,788
All sizes	10,531	10,112	397,376	501,640

The change between 1938 and 1943 occurred among those hatcheries with less than a 40,000-egg capacity. The larger hatcheries increased in number so that the net increase in egg capacity was 107,264,000, with 419 fewer hatcheries.

The egg capacity and number of hatcheries in size groups in the United States at the close of 1943 are shown in Table 34.

The six leading states in numbers of hatcheries in 1943 were: Pennsylvania, 636; Iowa, 624; Texas, 615; Ohio, 597; Minnesota, 538; New York, 498.

Chicks Hatched

The effort expended by poultrymen in the United States at the request of the U.S.D.A. to produce poultry meat and eggs as their part toward winning the war caused an increase in the number of chicks hatched in

Fig. 60. Sorting and packing chicks in the hatching room of a Northeastern hatchery.

1943 over 1938 of 105 per cent, or 1,609,121,000 in 1943 and 785,687,000 in 1938. The West North Central and East North Central regions exceeded all other regions both years. The South Central region from Kentucky to Texas was third in 1938 and, although it more than doubled its output in 1943, was nevertheless surpassed by the South Atlantic region from Delaware to Florida which tripled its output, and was third in numbers of chicks in 1943 (Table 35).

Table 35. Number of Chicks Hatched by Hatcheries, 1938 and 1943, Arranged in High-to-Low Order for 1943 [a]

Regions	Chicks Hatched (000 omitted) 1938	1943
West North Central	229,069	445,752
East North Central	222,786	399,555
South Atlantic	67,733	222,483
South Central	80,075	185,427
Middle Atlantic	70,601	140,216
New England	49,302	95,068
Pacific	51,859	94,992
Mountain	14,262	25,628
United States	785,687	1,609,121

Incubator capacity utilization. It is desirable to obtain high hatchability per 100 eggs set and per 100-egg capacity. Limitations of the incubation period (21 days) and of the hatching season previously pointed out means that the utilization of incubator capacity may vary widely in different sections of the country according to the particular demand of chick buyers. Certain wide-awake hatcherymen operate some of their machines for the entire year to meet a demand for special stock and all of their machines for as much of the remaining year as possible, using eggs from their own and supply flocks.

In the May 1935 U.S.D.A. survey,[6] 683 hatcheries used their hatching capacity from 0.27 to 8.69 times. Some hatcheries, therefore, failed to use their entire capacity once, whereas others used it more than 8 times. The average of all 10 regions was 2.77 times. Iowa and Missouri averaged 3.32 eggs set for each unit of capacity.

The 1937–1938 U.S.D.A. survey showed an average utilization capacity of 2.88. A slight tendency for greater use of capacity occurs as the size of the hatchery becomes larger. Hatcheries having 200,000 capacity and more set more than 3.5 eggs per unit capacity. All others were below that figure. The size of the hatchery had no significant influence on the percentage of hatch, although those smaller than 25,000 and over 500,000-egg capacity had a large majority of the specialized breeders and slightly higher hatchability (Table 36).

In 1938 more than 83.8 per cent of the hatcheries owned their own flocks, the percentage being higher in the groups having a 10,000-egg incubator capacity or less; 68.2 per cent of the hatcheries having 10,000- to 25,000-egg capacity and 69.6 per cent of the hatcheries having 500,000 capacity and above owned flocks. A much smaller percentage of hatcheries of 25,000- to 500,000-egg capacity owned flocks, which may ac-

Table 36. Eggs Set, Number per Unit of Capacity, and Percentage Hatched, by Size Groups, United States, 1938–1943 [4]

Egg Capacity Group	Total Set 1938	Total Set 1943	Per Unit of Capacity 1938	Per Unit of Capacity 1943	Percentage Hatched 1938	Percentage Hatched 1943
Under 10,000	34,623	40,752	2.54	3.57	68.9	68.3
Up to 24,999	124,302	161,234	2.58	3.73	68.8	68.9
Up to 39,999	139,736	204,956	2.58	3.92	68.1	68.2
Up to 59,999	158,389	258,783	2.59	3.97	67.8	68.0
Up to 99,999	188,901	367,806	2.83	4.20	67.9	68.0
Up to 199,999	198,533	412,746	2.84	4.86	67.6	68.6
Up to 499,999	187,864	482,093	3.55	5.66	68.3	68.1
500,000 and over	120,088	428,952	3.90	5.74	69.1	68.2
All sizes	1,152,436	2,357,322	2.90	4.67	68.2	68.3

count in part for the slightly lower percentage of hatch in this range of hatchery capacity.

Progress and improved efficiency occurred in the 5 years to 1943. In that year hatcheries set 4.67 eggs for each unit egg capacity. No group

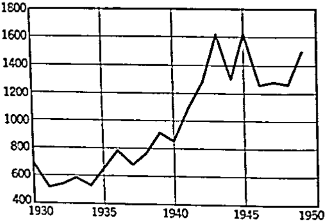

FIG. 61. Millions of chicks hatched in commercial hatcheries, 1930–1949. It is estimated that about 68 per cent of the eggs set produced chicks. (*Source: U.S.D.A. Agr. Statistics, 1950.*)

was under 3.5. As before, the tendency is toward better capacity utilization as capacity increases. The variation in hatchability was even less in 1943 than in 1938.

The larger hatcheries in Maine [7] also made better use of their hatchery capacity, varying from 4.7 (January–June) to 2.1 (July–December). The 57 hatcheries surveyed had an average capacity use of 5.6. The most efficient hatchery used its capacity 10 times. July to December

was a slack time, and nearly half of the hatcheries failed to use their capacity once (Table 37).

Table 37. Relation of Size of Hatchery to the Utilization of Incubator Capacity in 57 Maine Hatcheries, 1943–1944

Capacity of Incubator	Number of Hatcheries	Capacity Utilization: January–June	Capacity Utilization: July–December	Capacity Utilization: Year	Percentage of Chicks, July–December
Less than 5000	8	2.1	0.4	2.5	6
5,000–9,000	19	3.2	0.2	3.4	
10,000–29,000	20	3.8	1.0	4.8	20
30,000 or over	10	4.7	2.1	6.8	31
All hatcheries	57	4.2	1.4	5.6	26

Chick Prices

Prices paid to commercial hatcheries in the United States for chicks dropped to a low point of $7.34 per 100 during the depression period, when the index of chick prices also was the lowest in the 20 years 1930

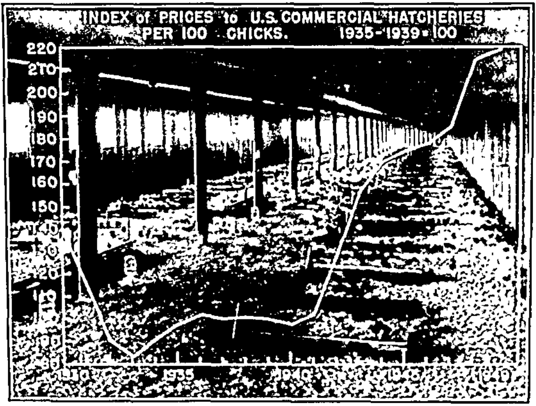

Fig. 62. Prices paid for chicks have increased greatly since 1940 and have followed the trend of the general price level. (*Source: U.S.D.A. Agr. Statistics, 1949.*)

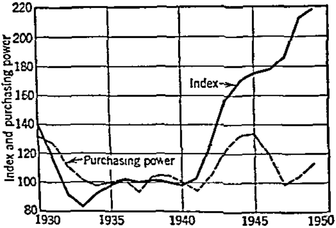

Fig. 63. Index and purchasing power of *prices of baby chicks per hundred* hatched by commercial hatcheries in the United States (1935–1939 = 100), seasonal average to May 1. (*Source: U.S.D.A. Agr. Statistics,* 1950.)

1949. Prices and the price index rose consistently after that to a price high of $18.70 in 1948 and $19.40 in 1949 and index figures of 212 and 219, respectively. Since 1940, a rising price level and high support prices have encouraged egg and chick production. However, in relation to the prices of other commodities, the price of baby chicks over the nation as a whole presents a less favorable picture. The purchasing power of chick prices held at a fairly consistent level from 1933 to 1941

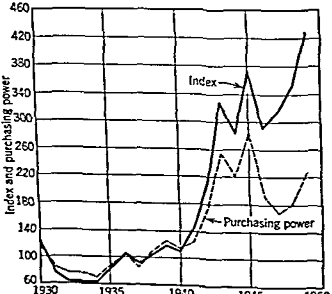

Fig 64. Index and purchasing power of the *total value of chicks produced* in the United States, 1930–1949 (1935–1939 = 100). (*Source: U.S.D.A. Agr. Statistics,* 1950.)

inclusive, then rose to a peak in 1944–1945. The purchasing power in those years was similar to that in 1930. Even at tremendously higher *chick prices from 1947 to 1949, the price index having risen 33 points,* the purchasing power has advanced but 14 points, still remains below *those of 1944 and 1945, but is favorable and advancing.*

The increase in number of chicks hatched since 1941, together with *consistently higher prices per 100 chicks, advanced the actual money* return for chicks in the United States more than 196 per cent. At the same time the index of the value of chicks produced increased from 146 in 1941 to 429 in 1949. Based on the 1935–1939 average the value of the baby chick business in the United States increased enormously. What this means to commercial hatcheries is shown in the index of purchasing power of the total value of chicks produced. This went from 134 in 1941 to a peak of 281 in 1945, then dropped to 166 in 1947, and has since been rising. On the basis of total returns to commercial hatcheries the business has paid well since 1938.

The South Central region in 1943 had the lowest prices paid for chicks and stood fourth highest in total value of hatchery chicks. The states involved are Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas. Highest prices were paid in the Pacific Coast states of Washington, Oregon, and California.

Ranked in the order of total value of hatchery chicks, the 16 states leading and in order, high to low, are: Iowa, Missouri, Illinois, Indiana, Ohio, Minnesota, California, Pennsylvania, Texas, Maryland, Kansas, Michigan, Delaware, New Jersey, Wisconsin, and Connecticut. All other states in 1943 were under $5,000,000.

Profits in Chick Selling

The financial advantage to poultrymen selling chicks has been evident in New York State for many years. Misner and Lee [8] showed that even in the depression years of 1932 and 1933 the farms selling chicks *made higher labor incomes than those not selling chicks.*

For many years several poultrymen in New York State have kept cost-account records, among which are several with incubation accounts. The profit per chick has varied from $0.03 to $0.07 for several years.[9]

Year	*Number of Farms*	*Profit per Chick*
1949	3	$0.0757
1948	3	0.0675
1947	3	0.0353
1946	3	0.0522
1945	4	0.0642
1944	5	0.0610

Factors Affecting Profits in Producing Chicks

In the survey by Warren and Wermel[9] on 683 hatcheries in 1934, covering 10 regions in the United States, capacity groups were set up from less than 10,000 to more than 500,000 eggs. The profit per 100

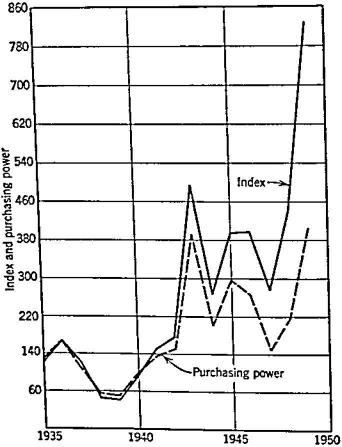

FIG. 65. Index and purchasing power of *profit from the farm incubation* enterprise accounts on New York State farms, 1935–1949 (1935–1939 = 100). (*Source: Cornell Univ Dept Agr. Econ.*)

chicks hatched commercially was smaller as the size of hatchery increased; practically all hatcheries operated at a profit; the return on capital invested was about the same in all size groups; a larger margin of profit occurred with the smaller hatcheries; and those sections where breeder hatcheries predominated reported higher margins of profit.

Poffenberger and DeVault[10] of Maryland (1936–1937) divided 110 hatcheries into three egg-capacity groups from 61,000 to 152,000 and found that the larger hatcheries yielded a higher net profit per 100 chicks hatched.

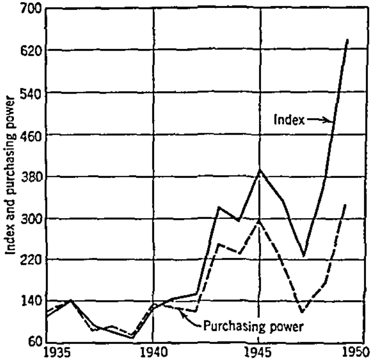

Fig. 66. Index and purchasing power of *returns per man-hour* from farm incubation accounts on New York State farms, 1935–1949 (1935–1939 = 100). (*Source: Cornell Univ. Dept. Agr. Econ.*)

Table 38 *

Year	*Average Number of Eggs Set*	*Percentage Hatch*	*Man-Hours per 100 Salable Chicks*
1949	76,837	83	0.7
1948	53,050	72	1.2
1947	69,724	65	1.0
1946	62,143	71	1.0
1945	59,053	60	1.0
1944	42,189	59	1.3
1943	72,288	66	1.2
1942	32,533	71	1.9
1941	29,389	64	2.0
1940	23,325	62	1.9
1939	13,879	65	3.0
1938	13,519	65	2.7
1937	28,247	63	2.6
1936	37,586	60	1.9
1935	36,150	62	1.8

* Summarized by Cornell University Department of Agricultural Economics from cost accounts.

Cost-account records in New York State for 1948 and 1949 each contained three incubation accounts. The results on these farms showed that the profit in incubation was related to the number of eggs set. The labor required and the net cost is much less per 100 chicks hatched when more eggs are set.

The number of eggs incubated has increased on these farms since 1935, and hatches have improved. Apparently the work is being done more efficiently, as shown by the decreased man-hours required per 100 chicks. The index and purchasing power of the return per man-hour together with the profit from incubation have generally improved in line with efficiency and in spite of a rising price level. This indicates a relatively strong position for the enterprise at prevailing prices.

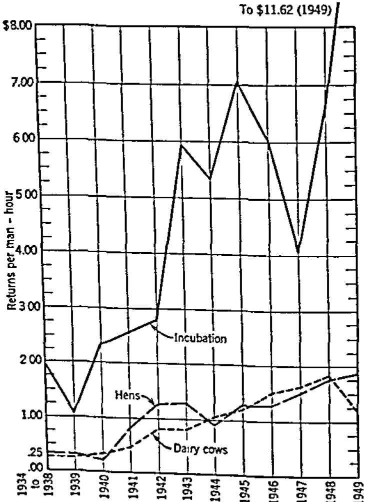

Fig. 67 Returns per man-hour in New York State from dairy cows, hens, and incubation, 1934–1948 Incubation has paid well for many years. (*Source: Cornell Univ. Dept Agr Econ.*)

*Table 39. Returns per Man-Hour in New York State, Averages by 5-Year Periods, 1914–1938, and Individual Years, 1939–1949 * (Dollars)*

Livestock Enterprises	*1914–1918*	*1919–1923*	*1924–1928*	*1929–1933*	*1934–1938*	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*1949*
Dairy cows	0.30	0.25	0.40	0.14	0.25	0.25	0.35	0.48	0.82	0.84	1.17	1.24	1.55	1.06	1.33	1.21
Hens	0.25 †	0.84	0.47	0.31	0.29	0.27	0.24	0.79	1.25	1.29	0.89	1.27	1.27	1.52	1.75	1.87
Raising chicks	—	—	—	0.46	0.33	0.29	0.23	0.42	0.57	0.87	0.32	1.00	0.63	0.36	0.10	0.27
Incubation	—	—	—	—	1.91	1.19	2.39	2.60	2.79	5.84	5.37	7.17	6.18	4.14	6.08	11.62
Sheep	—	—	—	−0.73	0.06	−0.03	0.59	−0.07	1.10	0.53	−1.19	0.03	1.09	0.89	—	—
Feeder lambs	—	—	—	0.04	0.18	−0.18	0.65	−0.23	0.74	0.23	0.37	−0.87	—	—	—	—
Hogs	—	—	—	−0.03	0.24	0.00	0.00	0.41	0.65	−0.06	0.41	—	—	—	—	—

* Summarized from cost-account records by Department of Agricultural Economics, Cornell University.

† Less than 5 years.

The annual averages from incubation accounts on New York State farms for the years 1935–1949 are shown in Table 38 and in Figs. 65 and 66.

Summary of Returns per Man-Hour

In comparison with other farm enterprises, hatching chicks has paid well for a number of years. As with most agricultural crops, a large volume gives the largest net return. Many poultrymen hatch the chicks they need, selling any surplus. It has been pointed out that as time goes on, fewer poultrymen produce their own chicks. The job then becomes one for the specialized hatcheryman. However, on farms in New York State, individual poultrymen, who have hatched their own chicks, have made attractive returns per man-hour. In Table 39 and Fig. 67 note the relative positions of incubation and hens with other cost-account enterprises.

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9 · Hatching-Egg Production

More than one-eighth of all laying hens in the United States are producing hatching eggs.

Hatching-egg production is developing into a year-around business.

Premiums are the profit motive for producing hatching eggs.

Hatching eggs cost more to produce than market eggs.

Hidden costs like hidden taxes cause very little mental anguish.

Profit from hatching-egg production may not exceed that received for market eggs.

The number of layers required in the United States to perpetuate the species is large. From a survey [1] in 1937–1938 (August 1–July 31) it was estimated that there were 42,531,000 hens in all flocks supplying eggs to commercial hatcheries, or an average of 107 hens for each 1000-egg capacity.

On January 1, 1937, hens and pullets on farms in the United States numbered 380 millions; in 1938, 353 millions. Thus, approximately 12 per cent of the layers were producing eggs for hatching purposes.

Hatching-Egg Demand

The demand for hatching eggs in recent years has increased as the number of layers and broilers has increased.

The length of the hatching season, especially for broilers, together with the premiums offered for hatching eggs, have made the production of eggs for hatching attractive to many. Premiums added to a price already attractive for market eggs has stimulated the business. The average annual wholesale prices, by regions, for market eggs show a considerable advance in recent years (Table 40).

The normal hatching season was formerly during the low egg price period of the year. However, for several years prior to 1952, broiler-chick and replacement-flock hatching has occurred at other seasons also, and this has made extra returns above the price of market eggs of considerable importance. Some producers have attempted to adjust their seasonal production to these conditions.

Hatching-egg production has moved from an incidental sideline undertaking to a specialized commercial enterprise on many farms

Table 40. Annual Average Wholesale Prices Received by Producers for Market Eggs, by Regions, and for the United States, for Selected Years, 1925–1948 *

Region	1925–1929 Average	1935–1939 Average	1941–1945 Average	1946	1947	1948
New England	43.5	31.4	42.2	50.1	62.1	66.7
Middle Atlantic	35.9	26.2	38.5	45.9	55.8	60.0
East North Central	28.3	19.9	31.0	35.2	43.4	44.7
West North Central	24.9	17.4	28.9	32.3	38.1	39.1
South Atlantic	30.8	22.1	33.4	41.7	49.1	51.5
East South Central	26.3	18.9	30.1	36.7	42.9	44.2
West South Central	24.6	17.7	29.3	34.7	41.1	42.5
Mountain	28.2	21.3	32.1	39.9	47.3	49.0
Pacific	30.3	22.8	36.8	45.1	54.0	55.9
United States	28.5	20.8	32.2	37.5	45.3	47.2

* *U.S.D.A.*

Types of Hatcheries

The breeder hatchery produces practically all of the eggs it uses. Large, specialized, commercial hatcheries have groups of producers, including breeder hatcheries occasionally, from whom the necessary eggs are purchased. Hatcherymen may raise or lower the base price paid for hatching eggs, depending upon whether they provide the males or the egg producer raises them.

Payment is usually a premium based on a stated market-egg quotation. This premium may be a certain amount above the quotation. Another method is to pay a base amount plus a second figure depending upon the percentage of hatchability and increasing with it.

The apparent price advantage over market-egg production has made possible a selection of supply flocks by the hatchery. Poultrymen find that the successful operator of a supply flock must be quite as efficient as he who operates a market-egg enterprise. Methods of payment shift as conditions change in the hatchery enterprise. All poultrymen do not receive the same premium; in fact, some may receive none at all, as shown by the farms reported in *Maryland Bulletin* 426, 1939. Of these 110 farms, 43 received no premium; 19 received $0.063; 32 received $0.10; and 16 received $0.148. Reasons for paying premiums are to give incentive for following a definite flock-improvement program and to produce high-quality eggs for hatching purposes.

A survey in 1944 of Maine poultry breeders and hatcheries[2] shows the premium variations which occurred at that time and gives reasons for the differences Most producers were paid premiums over the Boston-quoted price per dozen for large eggs (Table 41). Hatcheries usually

Table 41. The Variation in the Price Premium Paid by Seasons in Cents Per Dozen for Hatching Eggs, 199 Maine Flocks, 1943–1944

	Percentage of All Flocks					
Approximate Price Premium	*Year Ending Spring 1944*	*Spring 1944*	*Winter 1943*	*Fall 1943*	*Summer 1943*	*Spring 1943*
15	7	7	6	6	7	27
20	29	51	34	16	20	31
25	24	29	30	18	22	26
30	27	12	26	37	30	11
35	9	1	2	16	15	5
40	4	—	2	7	6	—
Total	100.0	100.0	100.0	100.0	100.0	100.0
Average premium	25.7	22.4	24.5	28.1	27.2	21.6

paid express or trucking charges, which were not deducted from the price the producers received.

Differences in prices paid were related to breeds and the season, primarily. During winter and spring sex-linked (New Hampshire males crossed with Barred Rock females) and straight New Hampshires brought highest premiums. In summer and fall, the broiler cross (Barred Rock males crossed with New Hampshire or Rhode Island Red females) brought more.

Straight New Hampshire and Rhode Island Red flock owners were paid higher premiums during winter and spring when flock-replacement chicks were in demand. New Hampshires slightly exceeded Rhode Island Reds in popularity. Premiums paid by various hatcheries in Maine differed from $0.15 to $0.40. Most poultrymen received premiums between $0.20 and $0.30, but a considerable number received more and less than those figures.

Other examples show similar variations, often depending upon hatchability of eggs, as well as breed, season of the year, volume of eggs, and the like.

The Cost of Producing Hatching Eggs

There are obvious costs in producing hatching eggs that are not experienced in producing market eggs. In addition, there are other costs that are less easily recognized. Premiums should cover all the extra costs incurred under efficient management together with some additional profit; otherwise there is no advantage for the egg producer to change from market-egg production. If the producer is not properly remunerated, one party is gaining at the other party's expense. An

evaluation of costs versus premiums for hatching eggs should help maintain a healthy hatching egg industry.

Accurate information on this subject is not readily available. Likewise, many of the costs are so hidden or submerged as part of other operating costs as to make exact interpretation difficult.

Extra Costs of Producing Hatching Eggs (items explained below)

- Feed.
- Depreciation of males.
- Selection and blood-testing charges.
- Layer space occupied by males.
- Eggs not suitable for hatching.
- Layers not suitable for breeding.
- Extra labor.
- Increased risk.
- Extra equipment and increased maintenance costs.
- Loss due to male activity.
- Reduced number of layers. Heavy vs. light breeds.
- Loss of eggs from certain strains.
- Price on which premiums are based.
- Length of hatching season.
- Loss of high-priced market eggs.

Feed. Mash for breeders must contain certain expensive ingredients necessary for hatchability, but unnecessary for market-egg production. Males consume the same mash. The feed cost per breeder is, therefore, higher than for layers.

Depreciation of males. To insure an adequate number of satisfactory males requires starting two or three times as many as will finally be needed, providing the flock owner rears them. At least 30 pounds of feed is needed per cockerel (light breeds), more with heavies, which may be 50 per cent of the total cost of rearing each cockerel. A definite charge should be made for the males needed. One may assume that feed and labor costs for the remaining males, at least until they are about 5 months old, will about balance the sale returns.

It may be necessary to retain males in sufficient numbers to offset an estimated mortality of about 8 to 10 per cent.

Meat value of old males at the end of the breeding season is not great: \$0.15–\$0.22 per pound has been common. The depreciation cost may be 30 to 35 per cent.

Selection and blood-testing charges. Extra labor for sorting out the birds suitable for producing hatching eggs is essential in a forward-

looking program. The cost may be estimated, or a stated amount per bird used, if the operator is a member of a state or national breed-improvement program.

The safest way of insuring a pullorum disease-free flock of breeders is to blood test the flock annually or oftener by an approved method and in accordance with the particular pullorum stage required and remove all reactors. This cost may vary in different states. In New York State the charge is $0.04 per bird.

Layer space occupied by males. Each male used in a breeding pen displaces a potential layer. Each layer lost means eggs lost and that, in turn, is a cost the operator pays when he produces hatching eggs instead of market eggs. An illustration is a farm in New York State producing New Hampshire hatching eggs, using 14,000 New Hampshire females and 1000 males. The same principle applies regardless of the size of flock. A loss of 150 to 200 eggs for each hen replaced by a male must be made up in extra returns from the sale of hatching eggs.

Eggs not suitable for hatching. From 2 dozen to 6 dozen eggs per bird, depending upon the variety and rate of lay, are unsuitable for hatching and must be sold at market-egg prices. Such eggs are those produced before flocks were mated, before eggs were saved for hatching, small eggs, too large eggs, poor shells, odd shapes, cracks, and others. Cases of such eggs offered on the wholesale market bring a lower price, although they might not had they been sold in normal proportions with other eggs. Fewer eggs per bird, therefore, are available on which premiums may be applied. The gross cost of producing hatching eggs is increased as the number of such eggs increases.

Layers not suitable for breeding are thrown out of the breeding flock because of some defect which might not impair their ability as market-egg producers. It becomes necessary to dispose of them altogether or maintain a market-egg flock comprised of such birds. A smaller number of birds may be suitable for hatching-egg production than for market-egg production in any given sized flock.

Extra labor is required by the operator for selecting and sorting eggs and in other management observation and work as, for example, replacement of inferior birds, males and females, through the hatching season.

Increased risk in several directions must be assumed by the producer. Delays in payment sometimes occur. The market price of eggs may drop during the hatching season, chick demand fall off, and the hatchery refuse the eggs, thus forcing the producer to sell on the wholesale market. The production flock may develop a disease, thus causing the eggs to be refused by the hatcheryman. Such possibilities are often the fault

of no one in particular, but the extra costs that have already been assumed by the egg producer offers a chance that an enterprise loss that year may be suffered.

Extra equipment and increased maintenance costs. Extra investment in equipment and supplies, buildings, range and coops for surplus males, and the like add to the depreciation, insurance, and interest charges over and above those required for the production of market eggs.

Loss due to male activity may mean: (*a*) fewer eggs per hen; (*b*) extra culls; (*c*) extra mortality, in some cases 5 per cent; (*d*) reduced sales value of hens (estimates vary from $0.03 to $0.05 per pound).

Reduced number of layers. Heavy vs. *light breeds.* Fewer heavies can be profitably kept in a given area than light breeds. One poultryman, urged to sell his Leghorns and supply heavy-breed eggs, found that the space occupied by 1200 Leghorns would only accommodate 900 heavies at 4 square feet per bird. Since part of this flock would be males, the actual number of layers would be considerably reduced.

Loss of eggs from certain strains. Certain varieties comprise two strains, one especially adapted for producing hatching eggs for future broilers and the other market eggs. Chicks from the hatching-egg strain develop and feather rapidly and well, but the *number of eggs per layer* is significantly lower than the egg production of the market-egg strain. Chicks from the market-egg strain develop and feather more slowly than those from the broiler strain and are, therefore, not in favor among broiler growers. Hence producers of hatching eggs for the broiler industry from such broiler strains shoulder the extra costs but have fewer eggs over which to distribute the costs.

Price on which premiums are based. A year-around hatching-egg business provides premiums based on seasonal price variations. This is likely to prove a better system than one based on short periods. Because of a wide seasonal variation in demand for replacement chicks, however, many producers will sell hatching eggs and obtain premiums *based only* on the low market price which prevails during the first half of the year. Part of the extra costs for producing hatching eggs may continue, for example, loss of eggs from certain strains, fewer females, and the like. Thus the costs of producing market eggs are increased during the balance of the year beyond what they would have been had hatching eggs not entered into the operation.

Length of hatching season. A short hatching season or low rate of production raises the cost of producing hatching eggs. A long hatching season or high rate of production lowers the cost.

Loss of high-priced market eggs. When hens that have laid nearly through a laying year are to be used for producing hatching eggs in the

coming season they should be thrown out of production about 4 months before chicks are expected. For February 1 chicks this means October 1, approximately. Many such hens would otherwise continue to lay through October and November, a time when market eggs are still high in price.

The tendency to purchase chicks earlier may require hatching eggs in late summer or fall months. Hens may be rested in early summer to meet this trade.* This method causes a loss of production during a high-price period for market eggs.

To overcome certain management obstacles and secure more hatching eggs per bird, pullets are being widely used. Careful selection of both layers and eggs combined with an inherited tendency to transmit desirable characteristics is making the use of pullets safer than was the case a few years ago.

On the credit side of hatching-egg production it is found that charges for transportation and cases are sometimes paid by the purchaser of hatching eggs. The market-egg producer ordinarily pays these costs.

An Estimate of the Costs of Producing Hatching Eggs from a Leghorn Flock, 1949

Table 42 shows an estimated comparison of costs of producing market eggs and hatching eggs, using similar figures as far as possible. An assumed cost is made of \$5.00 per cwt. for a laying ration and \$5.35 per cwt. for breeder mash. Pullets are charged at \$2.00 each. At the end of 6 months the survivors are valued at \$1.50 each as layers.

An average production of 56 per cent during the 6 months, or 180 days, equals 100 eggs. The gross cost of market eggs, using these figures, is \$0.40 per dozen. Assuming the gross cost as 70 per cent of the total cost, then \$0.57 is the net cost per dozen of producing market eggs.

For the hatching-egg flock, supplying males requires starting 2 or 3 times as many cockerels as will finally be needed, providing the flock owner rears them. At least 30 pounds of feed are needed to rear a cockerel, which may be 50 per cent of the total cost. Three dollars each for the 40 males used is charged. The assumption is made that feed and labor costs for the remaining 40 to 80 males will about balance the sale returns.

Many flock owners agree that there will be an additional 5 per cent mortality among the females in a mated pen. Ten per cent normal mortality is charged in both flocks. Applying the 5 per cent and then

* Method described in Rice and Botsford's *Practical Poultry Management*, 5th Edition, pages 375 and 376, John Wiley & Sons, New York, 1949.

distributed among all the eggs sold on the market. Valuing these eggs at $0.40 per dozen gives $344.

As the gross cost of all eggs in this estimate was $1761, and this is 70 per cent of the total cost, the total cost is $2516. Crediting the value of cull eggs, the net cost is $2172 or $0.80 per dozen and, in this instance, is 40 per cent above the cost of producing market eggs, or a difference of $0.23.

This figure of $0.23 compares closely with that of $0.215 (page 144) in the costs and credits of which are included all figures per 100 hens per day and which show 50 per cent greater cost in producing hatching eggs than that in producing market eggs.

In *Featheredfax*, December 1949, appeared the figures reproduced below, which were prepared by Homer R. Rowell, Groveland, Mass. Rhode Island Reds were used.

The figures are based on carefully selected breeding stock which has been subjected to several cullings. Labor charges for trapnesting, pedigree breeding or record work are not included, although they are part *of the job on this breeding farm. The extra cost of producing hatching* eggs was 50 per cent greater than the cost of producing market eggs, when production was the same in both flocks.

Cost of Producing Market Eggs

	Cost per Day per 100 Hens
Cost of feed	
21 lb. egg mash @ $4.00 per 100 lb.	
8 lb. scratch grain @ $3.60	$1.25
Labor (care of 100 hens and packing eggs based on 2000 birds for 1 man—feeding, packing eggs, cleaning house)	0.32
Investment, in buildings, equipment, egg room, *taxes, insurance and miscellaneous*	
$5.00 per bird; $500 for 100 hens	
5% interest on investment—$25 per year	
5% depreciation on investment—$25 per year	
Taxes, fire insurance, registration, insurance operation of *truck, supplies, and repairs*—$24 per year	
Total—$74 per year divided by 300 laying days	0.25
Pullet depreciation	
100 pullets @ $2.00 each when housed—$200	
20% mortality during year. After 300 days, end of year, 80 hens—6 lb. each @ $0.22 per lb = $105	
$200 − $105 = $95 depreciation	
$95 ÷ 300 days = depreciation per day	0.32
Total cost per day per 100 hens	$2.14

Cost of Producing Hatching Eggs

	Cost per Day per 100 Hens
Cost of feed	
24 lb breeder mash @ \$4.50 per 100 lb.	
8 lb. scratch @ \$3 60	
2 lb. buttermilk or supplement for \$0.13	\$1.50
Feed for 8 males per day	0.15
Labor, care of 100 hens and packing eggs	0.32
Investment in buildings, equipment, egg room, etc.	
\$6 00 per bird; \$600 for 100 hens	
5% interest on investment and 5% depreciation	
\$60 per year divided by 300 laying days =	0.20
Taxes, insurance, and miscellaneous, truck operation, supplies, repairs \$36 per year divided by 300 laying days =	0.12
Pullorum testing—\$0 05 for testing, \$0.03 for labor	
108 birds @ \$0 08 = \$8 64 ÷ 180 hatching-egg days (based on the sale of hatching eggs for 6 mos.)	0.05
Breeding pullets depreciation—100 selected pullets—\$240	
20% mortality, 80 hens 6 lb. each @ \$0 22 per lb. = \$105	
Depreciation \$135 ÷ 300 days =	0.45
Male depreciation—8 males @ \$3.00 = \$24 as cost	
At end of 180 days 7 males worth \$8 00	
Depreciation \$16 00 ÷ 180 days = \$0 09 per day	0.09
Costs and depreciation on 100 breeding hens per day	\$2.88

Summary and Extra Cost per Dozen in Producing Hatching Eggs per 100 Hens per Day (prepared by author)

At 60% production, 5 dozen market eggs would cost \$2 14 or \$0.43 per dozen.

On the basis of 60% production and 80% of these eggs grading as hatching eggs, we would get 48 hatching eggs and 12 rejects per day. These 5 dozen eggs would then cost \$0.74 more than the 5 dozen market eggs.

Crediting the rejects @ \$0.30, we find:

Credit for 1 doz. undergrades	0.30
Net cost per day per 100 hens	\$2.58

\$2.58 ÷ 4 doz. = \$0 645, cost of producing hatching eggs per doz.

\$0.645 − 0.43 = \$0.215 extra cost of hatching eggs per doz.

Comparison of returns from market- and hatching-egg flocks on 46 farms by Woodward in British Columbia,[3] in 1944–1945 showed no significant difference between incomes in the two groups, 33 market-egg flocks and 13 hatching-egg flocks. "The price received for hatching eggs just compensates for the additional expense, but not for any extra labor entailed in their production."

It appears desirable for producers of hatching eggs to consider the costs under their conditions and determine whether the extra effort and expense involved are compensated for by an adequate return. For many poultrymen market-egg production may pay better.

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10 · Chick Production

Cost of chick production:
- Is increasing.
- Is related to size of business
  - a. More profitable hatcheries hatch more chicks.
  - b. More profitable hatcheries have a larger investment.
  - c. More profitable hatcheries have a lower investment per 100 chicks hatched.
- Is closely associated with hatchability.
- Makes hatchability worthy of extra premium to the hatching-egg producer.
- Is considerably influenced by the percentage of hatchability and the price paid for hatching eggs.

The practice of sexing chicks is increasing in line with demand.
More Leghorns are sexed than other varieties.
It may be better procedure to sell chicks as day-old.
Interior egg quality of future layers may be worth much to chick sellers in the future.
The largest investment at the hatchery is in incubators.
Spring market-egg prices are often associated with chick demand.

In keeping with a rising price level, costs of incubation have increased. Highest individual costs are eggs and labor. Egg costs became higher as the value of commercial eggs increased after 1930 and as better hatchability and sorting for size, texture of shell, and the like became increasingly important to the hatcheryman. Egg cost varies seasonally with the commercial egg price. Labor charges have decreased in percentage and in actual dollars and cents. Responsibility for this may rest largely with improvements in incubators which are becoming more automatic and require less attention throughout the hatch.

Cost of Chick Production

1930

Nine Ohio hatcheries were classified into three groups according to volume of production (Table 43). As the size of hatchery increased, the proportion of production expense to total expense decreased, but selling and administrative expenses increased, both in percentage. The variation is slight. Egg cost was the highest percentage of the total cost, 52.9 per cent in Group 2 which had low hatchability, 57.08 per

Table 48. Comparative Average Expense per 100 Chicks with Percentage Analysis for Nine Hatcheries Combined;[2] Nine Ohio Hatcheries Classified according to Volume of Production, 1930

	Three Hatcheries Producing 25,000–47,000 Chicks	*Three Hatcheries Producing 75,000–169,000 Chicks*	*Three Hatcheries Producing 428,000–681,000 Chicks*	*All Nine Hatcheries*	
				Amount	*Relative to Total Expense*
Production expense					
Direct					
Egg cost	$3.75	$5.69	$4.51	$4.65	50.65%
Labor	1.32	0.88	0.88	0.91	9.91
	5.07	6.57	5.39	5.56	60.56
Indirect					
Heat, light, power and water	0.36	0.20	0.12	0.15	1.63
Supplies and sundry hatchery expenses	0.50	0.09	0.04	0.08	0.87
Repairs—fixtures and equipment	0.09	0.08	0.19	0.17	1.85
Taxes—personal property	0.05	0.06	0.01	0.02	0.22
Insurance—other than buildings	0.06	0.05	0.06	0.06	0.65
Depreciation—hatchery fixtures and equipment	0.51	0.50	0.20	0.27	2.94
Rent	0.12	0.12	0.26	0.23	2.51
Legbands and flock memberships	0.05	0.08	0.03	0.03	0.33
Automobile expense	0.08	0.09	0.03	0.04	0.44
	1.82	1.27	0.94	1.05	11.44
Total production expense	6.89	7.84	6.33	6.61	72.00
Selling and administrative expense					
Salaries	0.78	0.61	0.46	0.50	5.44
Advertising	0.94	0.51	1.11	1.02	11.11
Telephone and telegraph	0.13	0.01	0.08	0.08	0.87
Rent	0.09	0.07	0.03	0.04	0.44
Boxes and twine	0.16	0.11	0.07	0.08	0.87
Postage and express	0.09	0.18	0.38	0.34	3.70
Automobile expense	0.13	0.01	0.02	0.03	0.33
Office supplies and expense	0.02	0.08	0.01	0.04	0.44
Replacements	0.04	0.25	0.05	0.07	0.76
Association dues and flock improvement	0.10	1.01	0.21	0.31	3.38
Depreciation—office furniture and fixtures	0.01	0.01	0.03	0.03	0.33
Bad debts	—	0.01	0.04	0.03	0.33
	2.49	2.92	2.52	2.57	28.00
Total expense per 100 chicks	$9.39	$10.76	$8.83	$9.18	100.00%
Percentages of total cost of production					
Egg cost	39.98	52.88	50.96		
Labor	14.07	8.18	9.91		
Indirect expense	19.40	11.80	10.62		
Selling and administrative expense	26.55	27.14	28.48		
Total	100.00	100.00	100.00		

cent average for the season. Group 1 had an egg cost of 40 per cent and hatchability of 66.3 per cent. Group 3 averaged 51 per cent egg cost and 68.08 per cent hatchability.

Combining all nine hatcheries, egg cost is about 50 per cent and labor 10 per cent of the total cost of producing chicks. The total production expense was 72 per cent and selling and administration expense 28 per cent of the total. Total expenses per 100 chicks averaged $9.18.

Through the season from January 4 to June 7,* the average cost per 100 chicks hatched ranged from $9.18 January 4 to $4.16 June 7, and the average cost per 100 eggs ranged from $4.81 January 4 to $2.78 June 7.

The average selling price per 100 chicks at several hatcheries in Ohio ranged from $13.37 January 25 to $11.76 June 28, and the average margin between egg cost and selling price of 100 chicks from $4.19 January 25 to $7.60 June 28.

The cost of eggs decreased rather steadily from January to June, strengthening slightly during the latter part of April and in early May. The selling price of chicks advanced to more than $16 from March 8 to May 3, resulting in the greatest margin of profit between March 8 and May 24.

The *percentages* of the total cost of production in Ohio for the three groups of hatcheries are also shown in Table 43.[2]

1934

A U.S.D.A. survey of 683 hatcheries reported in May 1935 [1] covered the ten regions in the United States, at which time egg cost was 50.6 per cent of the total cost and labor 18.4 per cent. This is a considerable advance in labor cost over the Ohio figure of 9.91 per cent in 1930. See Table 44.

Table 44

Eggs	$3.55	50.6%
Labor	1.29	18.4
Relatively non-variable costs	0.65	9.3
All other costs	1.53	21.7
Total cost	$7.02	100.0%

1940–1941

A New York State survey of 34 poultry farms that hatched chicks at home, with an average of 23,653 eggs set per farm and 15,624 chicks hatched per farm, is summarized in Table 45.[3]

* Eggs hatched 3 weeks later than the weekly dates.

Table 45

	Per 100 Chicks Hatched	*Proportion of Total*
Costs		
Eggs	$5.25	64.2%
Labor, including cost of sexing	1.26	15.4
Use of buildings and equipment	0.90	10.9
Miscellaneous, electricity, advertising, boxes, disinfectant	0.70	8.6
Use of automobile and truck	0.07	0.9
Total	8.18	100.0%
Total miscellaneous returns other than chicks	0.22	
Net cost of incubation	$7.96	

1946–1949

The net cost in New York State of 100 chicks hatched on 3 farms each year was in 1946, $11.29, in 1947, $12.89, in 1948, $13.47, and in 1949, $11.32. Table 46 shows the method of arriving at the cost, using a total of 135,439 chicks for 1947.[9]

Table 46. Average per 100 Chicks Hatched

Costs	
154 eggs @ $0.066 per egg	$10.26
1.0 man-hour at $0 74 per hour	0 74
Fuel for incubator	0.33
Other costs of incubator	0.40
Chick boxes	0.08
Buildings	0.06
Automobile and truck	0.18
Sexing	0.18
All other	0.67
Total cost	12.90
Returns, other than eggs	0 01
Net cost per 100 chicks	$12.89
85.7 chicks sold @ $0.17 per chick	$14 57
6 3 chicks for own brooders @ $0.294 per chick	1.85
Total returns	$16.42
Gain per 100 chicks	$ 3.53
Percentage hatch	65%
Return per man-hour	$4 11

1949

A commercial hatchery in New York State produced chicks hatched for $11.41 per 100. However, this was accomplished by having an incubation utilization of 8.4 for the year. This is a very high figure. Costs have increased. Some of these multiply as the number of chicks hatched increase. Others decrease as volume of business increases. The incubator capacity of this hatchery in 1949 was 156,000, and the number of chicks hatched was 980,000 (Table 47).

Table 47

	Cost per 100 Salable Chicks Hatched		*Cost per 100 Salable Chicks Hatched*
Eggs	$7.76	Interest @ 4%	$0.22
Labor, hatchery	0.828	Boxes	0.28
Labor, office and administration	0.125	Parcel post	0.11
Heat	0.02	Postage	0.01
Light and power	0.07	Stationery	0.003
Repairs	0.26	Express	0.11
Disinfectant	0.01	Office supplies	0.04
Taxes	0.05	Replacement chicks	0.28
Insurance	0.05	Extras per box	0.44
Depreciation	0.03	Dues and fees	0.03
Auto and truck (fuel, oil, repairs)	0.06	Bad debts	0.05
Advertising	0.34	Sexing fees	0.11
Telephone and telegraph	0.08	Blood-testing fees	0.04
		Cost per 100 chicks	$11.41

Relation of Hatchability to Egg Cost

It appears that a price for hatching eggs based upon hatchability is sound procedure. Every egg that can be turned into a chick and sold is to the advantage of the hatcheryman. Each egg not salable as a chick increases the cost of the chicks from a dozen eggs.

Suppose the same price is paid for 2 dozen eggs. One hatches 10 chicks and the other 7. In the first case the cost is reduced per chick hatched and the return increased per dozen eggs purchased. In the second case the cost per chick is raised and the returns reduced for the dozen eggs purchased

The cost of eggs necessary to produce 100 salable chicks at various prices of eggs per dozen and at various rates of hatchability may be quickly determined by use of the nomograph in Fig. 68.

Chick sexing costs from $0.0075 to $0.01 per chick. The demand from market-egg producers for pullet chicks has increased. Cockerels are

sold by the hatchery at a reduced price. Many Leghorn cockerels, because of lack of demand, are destroyed at the hatchery.

A common method of pricing sexed pullets is to set a figure twice the price of straight-run plus the sexing charge for the cockerel and the pullet minus the price of the cockerel.

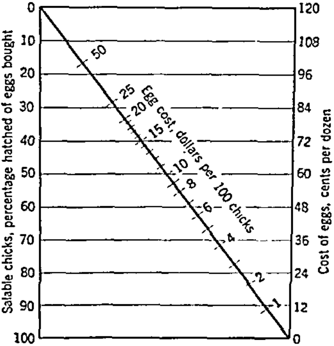

Fig. 68. Egg cost per salable chick hatched. On the left-hand side of the figure, the per cent of hatchability ranges from 0 at the top to 100 per cent at the bottom. On the right-hand side, the price of eggs per dozen ranges from 0 at the bottom to 120 cents at the top and the egg cost per 100 salable chicks hatched is calibrated on the diagonal line. By placing a straightedge at the price of eggs on one side of the chart and the per cent of hatchability on the other side, the egg cost per 100 salable chicks hatched appears on the diagonal line where the straightedge crosses it. (*Theodore C. Byerly*, "Breeding for Hatchability," *U.S.D.A. Conf., Natl. Poultry Improvement Plan*, page 61, 1936 *Reprinted from Univ. of Md. Bull.* 426, March 1939.)

For example, a Maine survey [4] showed the June 1944 price of straight-run heavies to be $0.158, the sexing charge $0.01 per chick, and the heavy-breed cockerel sale price $0.084.

$$\$0.158 \times 2 + \$0.02 - \$0.084 = \$0.252, \text{ the pullet price}$$

Kansas [5] purchases of chicks show that larger producers are more interested in sexed pullets, but more producers buy straight-run (Table 48).

Table 48

	Size of Flock			
	Large	*Medium*	*Small*	*Total*
Number of flocks	13	33	27	73
Percentage of purchasing				
Sexed chicks only	62	24	19	29
Straight-run chicks only	23	64	81	63
Both sexed and straight-run	15	12	—	8
	100	100	100	100

Fig 69 Chick sexers at work The demand for sexed chicks is constantly expanding.

According to a U.S.D.A. 1945 report,[8] the Leghorn is the predominating breed in commercial egg-laying flocks, and more Leghorns are sexed than any other breed. About 1 of every 6 chicks hatched in 1943, for the country as a whole, was sexed.

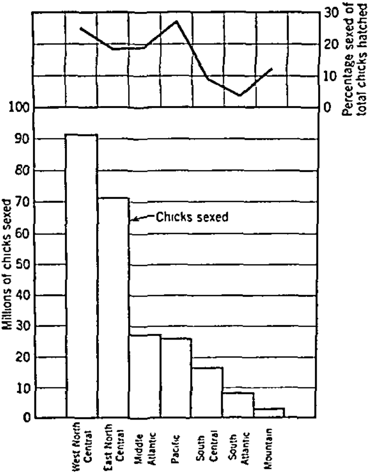

FIG. 70. Number of hatchery chicks sexed in the United States, 1943. Total, 250,201,000, or 16 per cent of total hatched. Many more chicks were sexed in the East and West North Central regions than in any other region. The percentage sexed of total chicks hatched was about the same as for the Pacific and Middle Atlantic regions, respectively.

Started chicks. In certain sections of the United States poultry pathologists discourage purchasing started chicks because of the disease menace. However, many hatcheries have developed this trade from a demand by poultrymen not equipped for brooding or because of lack of sale of all chicks as day-old.

A problem hatcheries face is that of correlating numbers of chicks with orders for chicks. Advance orders are a great help to the hatcherymen who can then set the necessary eggs and meet orders with the

minimum of surplus chicks. A higher price is usually obtained for brooded chicks. The expense of brooding is likely to be larger than the extra chick price received. However, hatcherymen must be prepared for the problem of holding extra chicks.

Other costs of incubation. In the interests of greater stabilization of the chick industry the National Poultry Improvement Plan involves extra services at extra cost to its members.

Laying and random-sample tests are used by many breeders and hatchery operators for official records.

Progressive breeder hatcheries take pride in continuous improvement of flock prepotency and strive to secure it by careful progeny-test work, involving, as it does, pedigree breeding and extensive record keeping. Heretofore, the maximum effort has been in developing laying capacity, reduced mortality, size, color, and shape of egg, and texture of shell. We are likely to see greater emphasis on building strains of poultry which combine with these qualities that of superior interior quality.

The National Poultry Improvement Plan

Since 1935, the National Poultry Improvement Plan has increased the number of participating hatcheries 356 per cent, the egg capacity

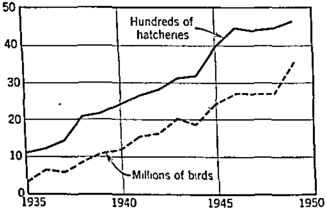

Fig. 71. Number of hatcheries and birds participating in the National Poultry Improvement Plan, 1935–1949. Hatcheries increased from 1017 to 4637 and birds from 3,522 000 to 34,700,000 in the 15 years 1935–1949, inclusive.

841 per cent, the supply flocks 346 per cent, the number of birds 885 per cent, and the number of states from 34 to 47 [6] (Fig. 71).

Hatchery Investment

The investment in a hatchery is necessarily large, but on the basis of 100 chicks it may be high or low, depending on the capacity utilization.

A higher use decreases the investment on a per chick basis. Cabinet machines have reduced the need for both land and buildings from that needed when small incubators were used and to a lesser extent from the requirements of long mammoth machines.

A survey of 110 Maryland hatcheries, 1936–1938, shows a hatchery investment only, for each 100 chicks hatched, of $5.02. The largest item is incubators, and the second is buildings [7] (Table 49).

Table 49

	Average per 100 Chicks Hatched	*Percentage of Total*
Land	$0.09	1.7
Buildings	1.12	22.1
Incubators	3.45	68.8
Battery brooders	0.13	2.6
Other brooders	0.02	0.4
Trucks	0.15	3.1
Miscellaneous	0.06	1.3
Total	$5.02	100.0

A modern hatchery in the Middle Atlantic region during 1949 hatched 980,000 chicks with an incubator capacity of 156,000. The incubation facilities were utilized 8.4 times during the year. Hatching is continuous the year around, with the months of heaviest sales being January to April, inclusive.

Considering the hatchery investment only per 100 chicks hatched, incubators and buildings are the two largest items (Table 50).

Table 50

	Average per 100 Chicks Hatched	*Percentage of Total*
Land	$ 0.201	5.6
Buildings	1.122	30.7
Incubators	1.48	40.4
Battery brooders	0.039	1.1
Other brooders	0.051	1.4
Trucks	0.51	13.9
Generator	0.153	4.2
Stitcher	0.031	0.8
Office equipment	0.069	1.9
Investment per 100 chicks	$ 3.66	100.0
Investment per 1000-egg capacity	$229.87	

Relation between Spring Egg Prices and Chicks Hatched

The curve of egg receipts on many of our markets follows closely that of chicks hatched. Highest receipts are in March, April, and May.

The spring months are important to hatcheries. The direction taken by egg prices in these months has a psychological effect on the chick purchaser. For example, during the spring of 1947 the price of large

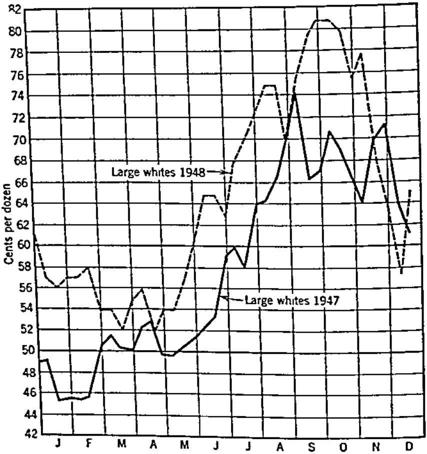

FIG. 72 Prices at New York City for 1947 and 1948, nearby white eggs.

whites was advancing. The number of chicks hatched that spring was 24 million greater than the year before (Fig. 61). Fall prices dropped rapidly, and the chickens raised held about the same as in 1946. In the spring of 1948, egg prices, although above those of 1947, were dropping. Chicks hatched dropped 28 million, and chickens raised dropped 108 million. The price went very high in the fall of 1948, and, after the seasonal drop in December 1948 and January 1949, rose consistently all through the spring of 1949. The high prices of 1948 and the rising prices during 1949 were accompanied by an increase of 243 million chicks hatched and 107 million chicks raised (Figs. 72, 73, and 74). Low

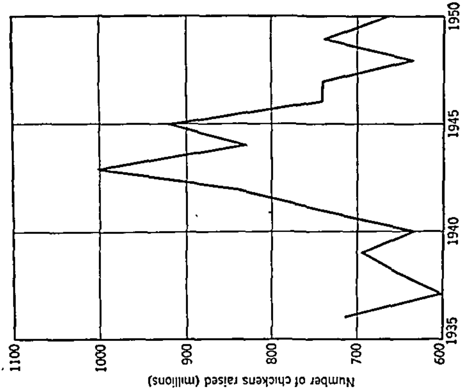

Fig. 71. Number of chickens raised annually in the United States, 1936–1949. (*Source: U.S.D.A. Bur. Agr. Econ.*)

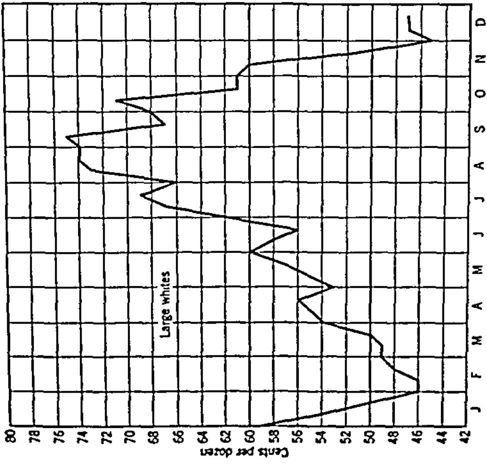

Fig. 73 Prices at New York City for 1949, nearby white eggs.

egg prices and less chickens raised in the spring of 1950 were followed by high fall and December egg prices.

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11 · Pullet Production

"Growing pullets" returns less per man-hour than producing market eggs.

It is usually safer and cheaper to grow the necessary pullets than to buy them partly or completely grown.

The kind and cost of brooding facilities best adapted to the job of producing pullets is worthy of thought.

Pullet production costs:

- have increased since 1943.
- are influenced by the sale of heavy cockerels.
- are cheaper with sexed Leghorns than sexed heavy breeds.
- are more expensive with sexed than straight-run Leghorn flocks.
- are likely to be more expensive in the East than the Middle and Far West.
- are lowered as the number reared increases.
- are related directly to mortality.
- are influenced in a small way by labor efficiency.

Costs of raising pullets on *New York State* cost-account farms have nearly doubled in the 23 years from 1927 to 1949. Costs on 9 farms in 1927 were $1.19 per pullet. In 1949 costs had risen to $2.12. This is due largely to the general rise in all prices.

Grouped by 5-year periods, the average number of chicks started per farm has increased and the amount of feed nearly doubled. Mortality has become less. It took on the average about the same number of man-hours from 1929 to 1948, and the return per man-hour was similar except during the depression years (Table 51).

Table 51. Five-Year Average Costs of Raising Pullets, 1929–1948, 642 New York State Cost-Account Records [1]

	Number of Accounts	Chicks Started per Farm	Pullets and Meat Birds Raised (Per Cent)	Died (Per Cent)	Average per 100 Chicks Started: Feed (Pounds)	Average per 100 Chicks Started: Labor (Hours)	Cost per Pullet Raised (Dollars)	Return per Man-Hour * (Dollars)
1929–1933	143	1513	76	24	1056	25	1.05	0.46
1934–1938	197	2259	78	22	1122	23	1.04	0.33
1939–1943	178	1993	82	18	1584	29	1.16	0.48
1944–1948	124	2236	83	17	2370	21	1.93	0.48

* Comparison with other enterprises will be found on page 133

The return per man-hour in raising pullets is less remunerative than that from producing eggs. However, it is better to grow pullets than to

buy them grown and thus avoid the danger of transmitting disease. The home-grown pullet, ready to lay, should have cost the operator less than if she were purchased grown.

In 1947, the cost of raising pullets on 21 cost-account farms in New York State was $2.20;[2] 39,124 chicks were started. The return per man-hour was $0.36; the labor return per 100 chicks started $9.52;* 27 hours of labor at $0.74 per hour were required per 100 chicks; 67.8 pullets were raised from each 100 chicks started; and feed cost per pullet reared was $1.54.

The similarity of results in both cost accounts and by the survey method is shown in figures giving the cost of raising pullets on 167 New York farms surveyed in 1947.[3] The state was divided into five areas in order to get a cross section from both the large commercial flocks in the east, central, and western areas and the smaller flocks in the south-western part of the state. No flocks were studied in the northern areas.

The number of chicks started per farm was 1896, of which 1279 pullets were raised to maturity, or 67.5 for each 100 chicks started. Mortality was 14 per cent. The costs and returns per pullet on the survey farms were:

Chicks	$0.47
Labor	0.35
Feed (32 lb.)	1.46
Buildings and equipment	0.18
Other	0.18
Returns other than pullets	0.36

This gave a total cost of $2.64 and a net cost of $2.28.

In 1949 the general price level started down. On 21 cost-account farms (Table 52) 44,009 chicks were started. Feed cost ($1.37 per pullet reared) and some other costs were lower than in 1947. Chicks and labor were higher, but the net cost of raising a pullet in 1949 dropped to $2.12. The return per man-hour was $0.27, the labor return per 100 chicks started was $6.86, and 71.8 pullets were raised from each 100 chicks started.

Two hours less labor were required but the value per hour had increased from $0.74 in 1947 to $0.87 in 1949.

On 182 north central *Indiana* farms[4] for 3 years, 1938–1941 (Table 53), costs were shown per 100 chicks started of $45.07 and a net cost per pullet of $0.63. Pullets were reared at a profit of $13.68 per 100 chicks started. Feed, chicks, and labor were the highest costs, in that order;

* Total cost minus cost of all labor subtracted from total returns.

Table 52. Detail Items in Raising Pullets, New York State:[1] Costs and Returns on 21 Cost-Account Farms Starting 44,009 Chicks in 1949, Average per 100 Chicks Started

Cost of raising 67.3 pullets to maturity	$ 2.12
Return per man-hour	0.27
Costs	
100 chicks started at $0.35 per chick	$ 34.94
1485 pounds of mash, @ $4.33 per cwt.	64.31
867 pounds of grain, @ $3.20 per cwt.	27.78
Other feed	0.21
Total feed	$ 92.30
25 man-hours @ $0.87 per hour	$ 21.72
Horse, automobile, truck costs	3.30
Poultry equipment	6.30
Litter	0.96
Interest	3.10
Fuel or heat	4.12
Medicine and disinfectants	1.09
Range and fences	1.02
Buildings	2.08
All other	1.32
Cost other than chicks, feed, and labor	23.29
Total cost	$172.25
Returns	
4.5 pullets sold @ $1.59 per bird	$ 7.17
11.8 meat birds sold or eaten @ $1.11 per bird	13.09
67.3 pullets for laying flock @ $1.93 per bird	129.70
2.5 breeding cockerels @ $2.08 per bird	5.21
14.0 birds died	
Total value of birds	$115.17
654 pounds of manure	$ 0.65
Eggs laid on range	1.57
Returns other than birds	2.22
Total returns	$157.39
Loss	$ 14.86

an average of 47.8 pullets was grown and 39.2 chickens other than pullets raised, making a total of 87 chickens grown from each 100 chicks started. Costs in 1949–1950 were higher, but it is probable that pullets can be grown more cheaply on Indiana farms than throughout the East.[*]

[*] L. B. Darrah in 1940–1941 found the average cost of raising pullets in New York State to be $1.12. This is $0.49 more than the 1938–1941 average in Indiana

Table 53. Summary of Receipts and Expenses per 100 Chicks Started for the Growing Flocks Studied in North Central Indiana, 1938–1941, 182 Farms

	Average, 3 years	*Average, Percentage of Total*
Receipts		
Pullets (47.8)	$44.09	74.8
Other chickens (39.2)	14.18	24.4
Manure	0.48	0.8
Total	$58.75	100.0
Expenses		
Feed (1270 lb.)	$21.50	47.7
Chicks	10.72	23.8
Labor (26.6 hr.)	6.26	14.0
Buildings and equipment	2.18	4.7
Fuel	1.60	3.6
Interest	0.79	1.8
Litter	0.60	1.4
Land	0.42	0.9
Auto	0.37	0.8
Horses and tractor	0.23	0.5
Miscellaneous	0.40	0.8
Total	$45.07	100.0
Net cost per pullet	$ 0.63	
Labor returns per hour	0.75	
Profit per 100 chicks started	13.68	

Sexing chicks. This practice is of relatively recent origin. For New York State no sexed pullet chicks were reported in 1926–1933. About one-third of the chicks purchased in 1940–1941 were sexed and, in 1946–1947, 70 per cent were sexed.[2,6,7]

Of the 167 *New York* farms surveyed in 1947, there were but 5 farms that had all Leghorn straight-run chicks. Hence they were not included in a comparison of sexed and straight-run costs, this number being too small for comparison purposes.

The cost of raising sexed Leghorn pullets was $2.27, and this was the same as that for straight-run heavy breeds. This cost was greater than in 1940–1941, when the net cost of raising sexed light-breed and straight-run heavy-breed pullets was $1.15 and $0.96, respectively. Sexed heavy-breed pullets were more expensive to raise in 1947 than they were in 1940–1941. The net costs were $2.49 and $1.32 respectively. Returns from heavy cockerels is an important item.

The cost of rearing pullets on 167 New York farms, by sex and breed, 1947, is shown in Table 54.

Table 54

	Sexed Pullets		*Straight-Run*
	Leghorn	*Heavy Breeds*	*Heavy Breeds*
Number of farms	52	38	12
Chicks started per farm	1096	1634	1347
Pullets raised to maturity	792	1055	428
Percentage mortality	13	10	23
Labor (minutes) per pullet	32	33	50
Feed (pounds) per pullet	25	34	50
Cost per pullet			
Chicks	$0.44	$0.38	$0.50
Labor	0.35	0.34	0.51
Feed	1.17	1.56	2.37
Buildings and equipment	0.17	0.12	0.20
Other	0.18	0.16	0.33
Total cost per pullet	$2.31	$2.56	$3.94
Returns other than pullets	$0.04	$0.07	$1.67
Net cost per pullet	$2.27	$2.49	$2.27

Although it costs more to rear them on many farms, the convenience in growing pullet chicks only is a great incentive to purchasing sexed pullets. To brood a given number of pullets less brooding equipment is required for sexed pullets, and, hence, a smaller investment is needed. On the other hand, to avoid undue crowding, the sexed pullets must be divided in a few weeks to give extra room similar to that which would prevail when the cockerels are removed and marketed from a straight-run flock. The age for dividing the pullet flock is about 8 weeks.

Darrah[8] has shown that the cost of rearing sexed pullets in both light and heavy breeds is greater than with straight-run chicks, presumably because of the return for cockerels with the latter. The difference was less pronounced in 1940–1941 between light breeds than between heavies. See Table 55.

Table 55

	Sexed Pullet Chicks		*Straight-Run Chicks*	
	Light Breeds	*Heavy Breeds*	*Light Breeds*	*Heavy Breeds*
Number of farms	25	11	30	14
Chicks started per farm	1214	1291	2881	2180
Pullets raised per farm	1000	952	1071	721
Percentage mortality	12.2	8.6	18.4	16.6
Pounds of feed required per pullet	23.1	31.4	31.0	39.2
Minutes of labor required per pullet	32.4	38.9	38.5	59.2
Net cost of raising a pullet	$1.15	$1.32	$1.02	$0.96

The cost of producing White Leghorn pullets on 60 *Indiana* farms starting sexed pullet chicks and on 101 farms with straight-run chicks, each group rearing about the same number of pullets, shows $0.087 higher cost in rearing sexed pullets (Table 56). The straight-run group

Table 56. Comparison between Sexed Pullets and Straight-Run Chicks in Relation to Various Factors in Growing-Flock Accounts, North Central Indiana, 1938–1941 [8,*]

	Sexed Pullets	*Straight-Run Chicks*
Number of records	60	101
Average number chicks started	974	1471
Average number pullets raised	740	622
Percentage of pullets raised	76.8	42.3
Percentage of other chickens raised	10.8	45.3
Percentage mortality	12.4	12.4
Cost per 100 chicks started		
Feed	$27.48	$20.71
Chicks	16.16	9.26
Labor	7.78	5.85
Fuel	1.95	1.45
Total	$60.25	$ 42.22
Value of meat sold and eaten per 100 chicks started	$ 3.80	$ 14.77
Value of pullets raised per 100 chicks started	68 79	39.97
Total receipts per 100 chicks started	73.84	55.51
Net cost per pullet	0.717	0.630
Labor returns per hour	0 802	0.817

* The figures in this table are unweighted averages of the factors for the three different years. Some of the differences shown in this table are due to the nature of the units used. One hundred sexed pullets is a different size unit from 100 straight-run chicks.

had a higher return for meat sold and used, which more than offset the extra brooder equipment and space required.

Indiana poultry-flock records, 1947–1948,[9] compare the cost of raising sexed pullets and straight-run chicks in heavy breeds and of sexed and part-sexed chicks in light breeds. Costs are higher than in the 1938–1941 average shown above. Heavy breed costs are less than those for light breeds, primarily because of the extra meat sales. The cost of raising straight-run pullets is less in both light and heavy breeds, but a smaller amount of equipment is needed for brooding sexed pullets, and the convenience of raising more pullets with the same equipment is apparently causing the sexed pullet chicks to gain in favor. The cost of raising pullets from sexed *vs.* straight-run chicks in 1948, as reported

in the Indiana poultry flock record summary, indicates a greater difference between sexed and straight-run in heavy than in light breeds.

	Heavy Breeds		*Light Breeds*	
	Sexed	*Straight-Run*	*Sexed*	*Part-Sexed*
Chicks started	3663	11,587	17,957	11,866
Net cost per pullet	$1.59	$0.89	$1.79	$1.74

Average costs of raising pullets are lower in *California* than in the East. However, in 1948, costs of 7 cooperators varied from $1.06 to $1.91. "This difference of $0.85 would amount to $850.00 per thousand pullets raised."[10] Costs have been increasing since 1941, the highest net cost year being 1946, for feed, chicks, and labor. See Table 57.

Table 57. Costs of Rearing Pullets to 6 Months, 1941–1948,[10] Los Angeles County, California (Averages of Several Records Each Year)

	1941	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*
Number of records	8	9	7	6	7	5	6	7
Costs								
All feed	$0.67	$0.74	$0.82	$1.08	$1.05	$1.37	$1.70	$1.50
Chicks	0.25	0.30	0.36	0.33	0.36	0.52	0.47	0.45
Hired labor	0.08	0.01	0.02	—	0.06	0.18	0.07	0.05
Operator and family labor	0.12	0.29	0.29	0.39	0.47	0.31	0.37	0.41
Litter	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.01
Fuel	0.02	0.01	0.03	0.03	0.03	0.04	0.03	0.02
Miscellaneous expense	0.01	0.02	0.03	0.01	0.03	0.08	0.03	0.04
Total cost *	$1.15	$1.39	$1.57	$1.87	$2.02	$2.52	$2.68	$2.48
Income								
Cockerels and pullets sold	$0.14	$0.07	$0.17	$0.23	$0.40	$0.38	$0.70	$0.36
Eggs sold	0.06	0.11	0.10	0.09	0.16	0.16	0.29	0.25
Miscellaneous income	0.03	0.03	0.03	0.02	0.01	0.04	0.06	0.05
Inventory credit †	—	—	—	—	—	—	0.33	0.38
Total income	$0.23	$0.21	$0.30	$0.34	$0.57	$0.58	$1.38	$1.04
Net cost	$0.92	$1.18	$1.27	$1.53	$1.45	$1.94	$1.30	$1.44
Net cost, straight-run chicks	0.85	0.87	1.01	1.18	1.09	1.90	1.43	1.54
Net cost, sexed pullet chicks	1.08	1.18	1.36	1.66	1.58	1.94	—	1.50

* Interest and depreciation not included.

† Net inventory credit for birds under 6 months.

Size of Flock or Number of Chicks Brooded

The advantage to the hatcheryman in selling a large number of chicks to one customer is reflected in a lower price per chick. The man-hours required in caring for a larger flock is less per chick, because, once arrived at the brooder, a larger number can be cared for with but little more time than that needed for a smaller flock.

If a long pipe-heated brooder is used, the number of chicks in one large pen may run into several thousands. In this event, the labor in

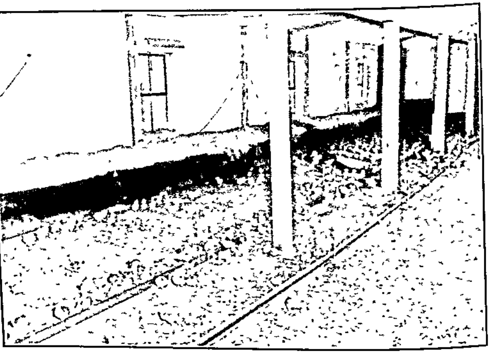


Fig. 75 Two-weeks-old New Hampshires in overhead-pipe-heated permanent brooder. Paper over pipes will be removed later Pen is equipped with automatic feeder and running water Litter is shavings.

servicing one heater and occasionally checking temperatures in the pen differs but little from that required for a small flock. Several colony-brooder stoves in one large floor area also cuts the labor cost compared to an equivalent number in colony houses.

One colony-brooder stove in a pen equivalent to 1 square foot per chick permits brooding 500 or 600 chicks per stove. In a colony house *250–300 chicks* with one brooder is the maximum. Chicks will consume about the same amount of feed per bird whether in large or small flocks. Wastage or loss by rats or mice or other animals may be less in large flocks, which often are under better supervision and care than may prevail in the small flock. Better pasture and lower grain costs often re-

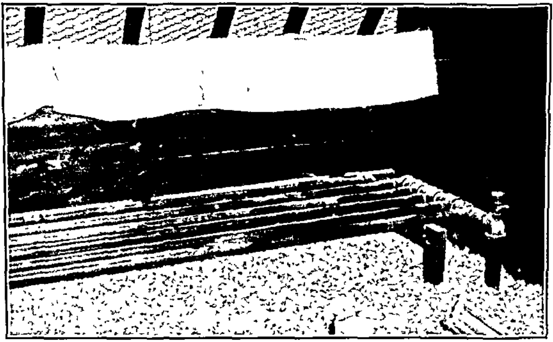


Fig. 76. Section of overhead-pipe heating system showing header and raised cover.

duce expenses for large flocks. Large flocks, therefore, reduce the cost of raising pullets.

On 90 farms in *New York State* in 1947, flocks were separated into sexed Leghorns and sexed heavy breeds, and each group in turn was divided into those brooding fewer than and more than 800 chicks.

The net cost of raising a pullet in both groups having more than 800 pullets was lower than that where the number of pullets reared was below 800. The difference was \$0.60 with Leghorns and \$0.49 in the heavy

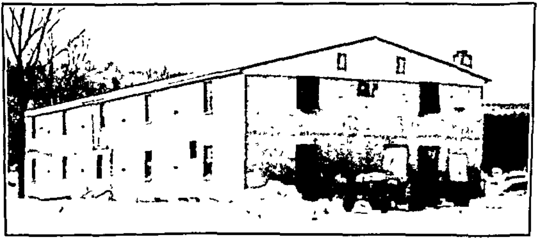


Fig. 77. Two-storied cinder-block house, hot water pipes above floor, coal heated (*Courtesy V. C. McGregor and Sons.*)

flocks. Costs that were lower were chicks, labor, feed, charges for buildings and equipment, and other costs, except for interest, which remained the same in all groups.[3]

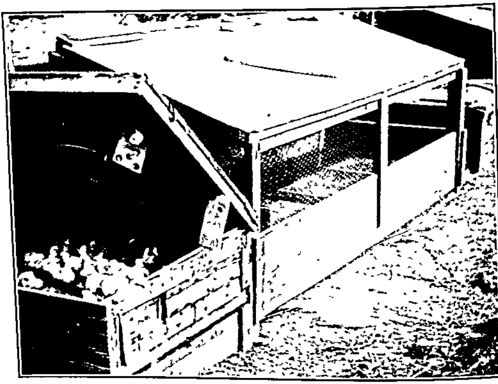


Fig. 78. Electrically heated sunshine brooder, San Bernardino County, California, 3' x 4' with outside wire-enclosed run. Capacity, 100 chicks Ranch capacity, 3000 layers.

Effect of Chick Mortality on Cost of Rearing

Extra chicks are ordinarily given with each 100 chicks purchased. These "extras" help reduce the mortality costs per 100 chicks purchased.

Each dead chick after the extras are gone represents a monetary loss which has to be divided among the remaining chicks, thus increasing the cost of raising a pullet.

The older the chick is at death, the greater the monetary loss, as feed, fuel, labor, etc., must be prorated among the survivors.

Lower mortality results in a lower cost per pullet reared in both light and heavy breeds. On 90 New York farms sexed light and heavy breeds were divided into flocks having mortality below and above 13 per cent. The net rearing costs were, respectively, for these 4 flocks of light and heavy breeds, \$2 18 and \$2.43, and \$2.39 and \$2.88.

Sicer[4] of Indiana shows the relationship between mortality and cost from flock-record cooperators in 1948 In addition to an increased cost

per pullet as the mortality increased, and in both light and heavy breeds, the size of flock may have been an influence. The group with 13.5 per cent mortality appears out of line. Sicer explains this as being partially due to the comparatively small percentage of sexed pullets started in this group. See Table 58.

Table 58

	Mortality Range	*Number of Chicks*	*Average Mortality*	*Average Cost per Pullet*
Light breeds	Under 15%	18,311	8.7%	$1.65
	Over 15%	9,944	23.4%	2.12
Heavy breeds	Under 5%	3,199	3.5%	1.08
	6 to 10%	7,740	7.1%	1.10
	11 to 15%	3,819	13.5%	0.83
	Over 15%	1,816	36.0%	2.38

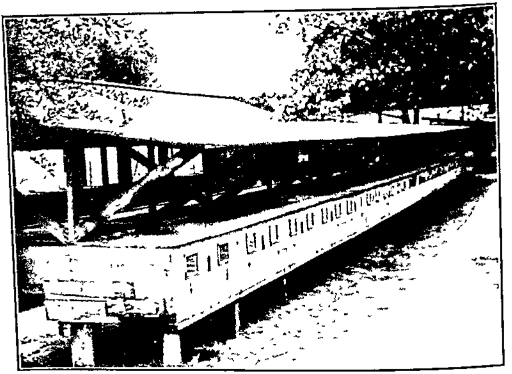
Labor Efficiency in Raising Pullets

We have pointed to the saving in labor resulting from the use of a long brooder house. Other labor-saving devices are automatic watering, larger waste-proof feed hoppers, proper litter management and reduced cleaning of dry, well-pulverized litter. Size of flock is a most important influence in the amount of labor used.

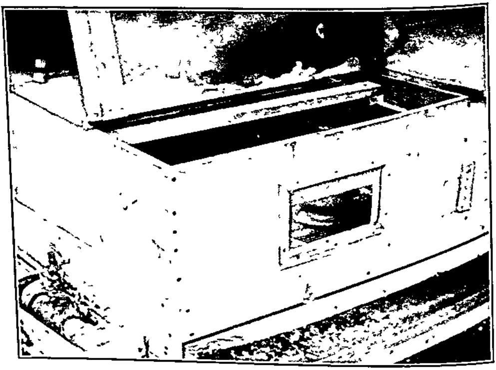
Pickler[3] of Cornell measured labor efficiency in terms of man-hours per pullet. He separated the flocks into sexed Leghorns and sexed heavy breeds, and divided each in turn into those using fewer than 0.7 and more than 0.7 man-hours per pullet raised. The number of minutes required, the cost of labor, and the net cost of raising a pullet was lower in both Leghorn and heavy-breed flocks using less than 0.7 man-hours per pullet. The saving with Leghorns was 46 minutes, $0.51 in labor costs, and $0.63 in the net cost of the pullet. The difference between the sexed heavy-breed pullets was 31 minutes, $0.37 in cost of labor, and $0.63 in the net cost of the pullet. The lower labor charge helped reduce the net cost per pullet. Labor, although generally a smaller item than feed or chick cost, may have a very considerable cost influence on inefficient farms.

It should be stated that the size of flock was larger in those using less labor per pullet and that the figures stated are, in effect, a measure of size. The flocks of sexed Leghorns using less labor per pullet averaged 561 more pullets raised. The more efficient sexed heavy-breed flocks were larger by 918 pullets.

The amount of time required per 1000 birds under different systems of heating showed considerable variation in Virginia, 1946–1947.[11] The



(*A*)



(*B*)

Fig 79*A* Natural-gas-heated brooders Hot water piped beneath the floor. Individual brooders built in units 30" square, 30 chicks each, San Bernardino County, California *B* Close-up of one compartment in *A* Chicks run on wire. Droppings cleaned from below.

radiant or underfloor-heated houses were newer and had advantages of larger business, lower mortality, more efficient use of feed, and faster gains. They were equipped with automatic water systems. It is likely that the combination of advantages, rather than any one, reduced labor. Only 40 of the 293 heated in the usual manner were equipped with automatic waterers; 253 lots were severely handicapped thereby.

In this comparison 8 lots of broilers were brooded with underfloor heat and 293 lots with other types of brooders. Labor per 1000 chicks started was considerably less where underfloor heat was used. The main difference in man-hours among the 10 lots having other types of centrally heated brooders and the group with underfloor heat is apparently in ease of floor cleaning.

	Average of 8 Lots with Underfloor Heat	*Average of 293 Lots*	*Average of 10 Lots with Other Types of Centrally Heated Brooders*
Average number started	6850	1935	—
Man-hours per 1000 started	35	167	62
Labor daily per 1000 started	0.4	1.8	—

Tests at the University of Hawaii Agricultural Experiment Station [12] showed a reduction of labor required as the size of flock increased. It is also pointed out that more labor is needed for battery brooding than for floor brooding. See Table 59.

Table 59. Relationship of Number of Chicks per Pen to Labor Required per Chick Through 6 Weeks of Age (Hawaii Agricultural Experiment Station, 1950)

	Floor Brooding *		*Battery Brooding*		
Trial	*Number of Chicks per Pen*	*Minutes of Labor per Chick*	*Number of Chicks per Battery*	*Number of Chicks per Tier*	*Minutes of Labor per Chick*
1	40	5.72	40	40	7.01
2	350	1.10	100	50	2.60
3	745	1.03	100	50	2.69

* Chicks were on litter. Heat supplied by 250-watt, ruby-glow heat lamps suspended 19 inches above the upper surface of the litter.

Comparison of Methods of Heating for Brooding Chicks

Work at Hawaii [12] showed, under their conditions, that floor brooding is more economical in the use of electricity than battery brooding. Moreover, when the number of chicks brooded under one lamp increased the cost decreased. See Table 60.

Table 60. Comparison of Floor and Battery Brooding, with Electric Heating, for Chicks through 6 Weeks of Age (Hawaii Agricultural Experiment Station, 1950)

	Floor Brooding			Battery Brooding		
Trial	Number of Chicks per Pen	Number of Chicks per Lamp	Kilowatts of Electricity per Chick	Number of Chicks per Trial	Number of Chicks per Tier	Kilowatts of Electricity per Chick
1	40	40.0	4.31	40	40	2.84
2	350	87.5	1.10	100	50	1.50
3	745	124.2	0.85	100	50	1.56

In Maine,[13] oil for brooding was found more expensive per 100 chicks sold than coal or wood. See Table 61.

Table 61. Cost of Operating Brooder Stoves per 100 Broilers Sold, Maine Broiler Flocks, 1945

Fuel	Average Chicks Started per Lot	Fuel Cost per Gallon, Ton or Cord	Fuel Cost per 100 Broilers Sold
Oil	584	$ 0.094	$3.58
Coal	2193	16.48	2.32
Wood	772	12.62	2.01

Effect of Type of House Construction on Cost of Oil Heat

The Purdue Experiment Station[14] compared costs for winter and summer per 1000 chicks during 1947 and 1948, and reported that concrete houses were the most expensive to heat, costing $65 in winter and $14 in summer. Frame houses were second in winter at $45 and lowest in summer at $8. Tile-block houses were least during winter brooding and second during summer at $33 and $13, respectively. Brooding in winter involved starting in December, January, or February, whereas summer brooding began in June, July, or August.

Radiant or Underfloor Heat

Hot water or steam pipes (usually hot water) are laid in or directly under the concrete floor. The floor then functions as a low-temperature heating panel of large size, and heat is radiated through the room. Similar boilers, pumps, valves, thermostats, and pipes are used as in any ordinary hot-water system for brooding.

Plaxico of Virginia[11] reports on 11 underfloor heated houses and compares the results with 104 farms, 10 of which had central heating systems and the balance coal stoves. "The 11 houses had an average brooding space of 4172 square feet, 5 were 2-story, and there was an average of

2.4 rooms per house with 1765 square feet floor space per room. All had hot water pipes, copper pipes in 3 installations, and the balance iron pipes."

Heat was thermostatically controlled in all but 2 houses; 1.7 hot-water circulators were used per house; 6 of the 9 furnaces burned coal, (2 producers used 1 furnace for 2 houses). Five of these furnaces were stoker fired. Three houses had automatic oil burners.

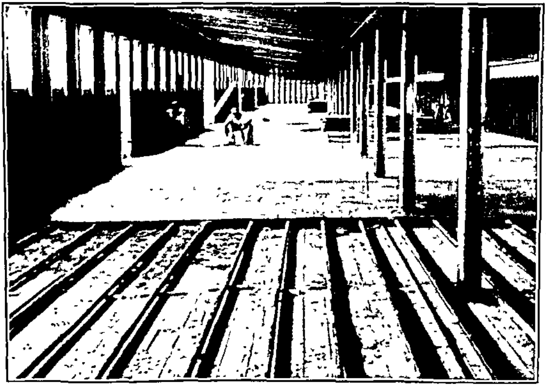


Fig. 80. Concrete being laid around the pipes in an underfloor heating installation. *Water-supply pipes are laid at the same time, thus insuring non-freezing* conditions and a smooth floor for cleaning. *(Courtesy E. I. Robertson, John W. Eshelman and Sons.)*

Eight houses had pipes spaced over the entire floor area. Three houses had pipes only in the 4-6 feet of floor area at the rear.

In this survey, the author notes that the buildings containing radiant heating were newer and were constructed at a higher price level than were those on the other 101 farms. Results are not strictly comparable, therefore. See Table 62.

At prices prevailing in Virginia in 1946–1947, the cost of equipping a house with coal brooder stoves was $0.08 per square foot.

Investment in buildings and overhead costs were higher and fuel costs per 100 chicks started considerably lower with radiant-heat installations. Without a repair charge for new installations, the overhead

Table 62. Construction Costs of Brooder Houses, 9 Radiant or Underfloor Heated and 104 Heated Otherwise, Rockingham County, Virginia, 1946–1947*

	Average of 9 Radiant-Heat Installations			Average of 104 Broiler Farms not Radiant Heated		
	Total	Percentage of Total	Per Square Foot	Total	Percentage of Total	Per Square Foot
Buildings	\$5582	71	\$1.22	\$1095	83	\$0.51
Heating equipment	2011	26	0.44	105	8	0.05
Other equipment	252	3	0.06	124	9	0.06
Total	\$7845		\$1.72	\$1324		\$0.62

* The 9 installations were thermostatically controlled.

was \$47.40, as against \$26.78 for the usual heating systems. The proportion of chicks started during the cold months was the same for each type of heat. See Table 63.

Table 63. Cost of Operating and Fuel Cost per 100 Chicks Started, 9 Radiant-Heating Systems and 104 Non-Radiant-Heating Systems, Rockingham County Farms, Virginia, 1946–1947

	Average of 9 Radiant-Heat Installations (per 1000 sq. ft.)	Average of 104 Farms with Stoves and 10 with Central Systems (per 1000 sq. ft.)	Average of 10 Farms with Central Heating Systems
Depreciation	\$22.03	\$13.60	—
Interest, taxes, insurance	25 37	3.23	—
Repairs	—	9.95	—
Total overhead	\$47.40	\$26.78	—
Fuel cost per 100 chicks started	0.68	2.43	\$1.50

The amount of fuel used and the cost per 100 chicks is related to the time of year brooding is done, the section of the country, change in climatic conditions, type of brooder construction, size of pen. heating equipment, number of chicks in one flock, kind and quality of fuel, and freedom from trouble.

In Virginia (Tables 62 and 63) radiant or underfloor heating installation cost more per square foot to construct and less for fuel to operate per 100 chicks than small coal brooders.

From preceding figures, it appears that underfloor installation is more expensive than the overhead-pipe hot-water systems.

On the basis of 100 chicks, the cost of fuel (from a study of several farms by the writer) showed during 1950 a rating from most to least expensive as follows: *small stoves,* oil, coal, electricity; *large units,* oil, coal.

Table 64 shows that in 1949 cinder-block construction was lower than frame construction per square foot in at least two instances. For each 1000-chick capacity, the oil-heat installation cost nearly as much as the coal heat, although the coal heat had 4 pipes laid in the floor in addition to those above the floor, which both installations used. The cost per square foot of brooder house was $1.02 and $1.22, respectively, for cinder block and lumber; for the heating system $0.302 and $0.306; and for constructing and heating systems combined $1.33 and $1.53.

Table 64. Comparison of Brooder Fuel Costs in New York State, 1950, for Several Types of Heating Systems

	Individual Oil Brooder Stoves	*Hot Water Pipes on Sides—Oil Heater*	*Electric Brooder*	*Coal-Stove Brooders*	*Coal-Hot Water—Pipes Both Sides and One for Each 12' in Floor*
Total chicks brooded	2477	12,000	312	1800	50,000
Chicks per unit, average	619	2,500	312	360	7,500
Fuel per stove per brood	196.3 gal.		393 kw., 8½ wk. 495 kw., 10 wk.	1083 lb.	
Fuel per 100 chicks started	30.8 gal.	13¾ gal.	126 kw., 8½ wk. 147 kw., 10 wk.	277.8 lb.	250 lb.
Fuel cost 100 chicks started	$4.60	$1.69	$2.77 8½ wk. $3.23 10 wk.	$2.99	$1.35
Cost of fuel per unit	$0.149	$0.123	$0.022	$21.50 per ton	$11.25
Type of house	*Frame, concrete floor*	*2-story cinder block*	Barn, concrete floor	Barn, wood floor	*2-story* wood
Size of house or pen	25' x 25'	30' x 100'	8' x 8' enlarged as chicks grew	—	60' x 150'
Cost of brooder houses	—	$6151.52	—	—	$22,000
Cost of brooder house per square foot	—	$1.025	—	—	$1.22
Cost of brooder per 1000-chick capacity	—	$1025.25	—	—	$1222.22
Cost of heating system installed	—	$1812.99	—	—	$5500.00
Cost of heating system per 1000-chick capacity	—	$302.16	—	—	$306.55
Cost of heating system per square foot	—	$0.302	—	—	$0.306
Cost of house and heating system per square foot	—	$1.327	—	—	$1.526

Costs per chick of installing several kinds of heating systems, both in large central units and individual stoves, for a considerable number of flocks in each type, and including four different types of heat used at the University of Delaware, Georgetown, sub-station show the averages in Table 65.[15]

Table 65. Installation and Fuel Cost per Chick Started (Cents)

Central Heat	*Installation Cost*	*Fuel Cost*
Hot water, coal fired	20–25	0.6
oil fired	20–25	1.0
Infra-red	18–20	2.7
Direct hot air, oil fired	16–20	1.5
Indirect warm air, coal fired	12–18	1.0
Individual Stoves		
Electric	10	1.5
Gas	9–11	1.6
Coal	8	1.9
Oil	7	2.3

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12 · Size of Business

There are certain business factors found in the management of any laying-flock enterprise which influence income, whether the flock consists of one hen and her chicks or many thousands of birds. Studies over many years in all parts of the country have shown their importance from a business standpoint. These factors are:

Size of business.
Rate of production.
Mortality.
Labor efficiency.
Capital efficiency.

Size of business influences both labor income and profit by increasing or decreasing returns and costs typified by the amount of salable products and by requiring more or less labor and equipment to care for a given number of birds. There are times when a small business is better than a large one:

1. When we have low rates of production.
2. When we are working with poor producing strains or the wrong breed.
3. When labor efficiency is poor.
4. When the years are very unfavorable.

Size of business is:

Not associated with rate of production.
Favorable, if large, and a profit per layer is realized.
Unfavorable, if large, and a loss per layer is realized.
Less favorable, if small, and a profit per layer is realized.
Related to size of labor income and management income or profit.
Related to total hours of labor.
Likely to be related to hours of labor per hen.
Not associated with income per hen.
Not associated with mortality.
Sometimes accompanied by better marketing.
Related to costs and returns.

Table 68

Size of Flock	*Eggs per Bird*	*Mortality*	*Labor Income per Bird*
0–399	178	15%	$2.83
400–799	186	14	2.99
800 and over	180	10	2.80

In New Hampshire Abell[3] used 243 records in an economic analysis extending over 14 years—1931–1945. These years include the troublesome periods of the depression of 1933, the pre-war, and World War II years. Labor incomes fluctuated with the price of eggs, the general price level, and the considerable change from market-egg to hatching-egg production brought about by the tremendous demand from broiler-producing areas.

Grouping these 243 records into 3 divisions, the labor income per farm is affected by size of business represented by number of layers. No relation exists between size of flock and labor income per bird (Table 69).

Table 69

Number of Farms	*Number of Layers*	*Labor Income per Farm*	*Labor Income per Hen*
90	298	$ 464	$1.66
110	702	1183	1.68
43	1384	2062	1.47

Statistical tests applied by the University of British Columbia[4] to records secured from poultrymen failed to show that a relationship could be established between size of flock and labor income per bird. However, labor income increased as size of flock increased. The university in 1944–1945 surveyed 46 poultry farms in coastal British Columbia (Table 70).

Table 70

Number of Farms	*Average Number of Layers*	*Average Labor Income*	*Labor Income per Bird*
17	309	$ 509	$1.59
22	754	1196	1.58
7	1193	1590	1.37

In a study of 32 cost accounts in Pennsylvania,[5] October 1, 1946, to September 30, 1947, Hawthorne found that "as a flock increases in size, greater efficiency in the use of labor and capital and in marketing methods becomes possible." Production and profit per layer increased with size of flock (Table 71).

Table 71

Average Number of Layers	*Number of Flocks*	*Eggs per Layer*	*Man-Hours per Hen*	*Profit per Layer*
241	11	167	2.5	$-0.28
645	12	191	1.6	1.28
1531	9	193	1.5	1.67

Figures from Indiana poultry-record-keeping cooperators[6] have shown that "larger farm flocks lead to more eggs per hen, more money per dozen eggs, more profit per bird, more returns per hour of work, and more cash per farm." On the farms of Indiana the small flock was too small to return a large labor income, although the egg production and the labor income per hen were high. The total eggs to sell was high per layer, but not large per farm. The price received per dozen increased as the total number of hens and eggs increased. These are important factors and, when taken together, produce excellent results. See Table 72, covering light breeds.

Table 72

Size of Flock		*Average Price per Dozen Eggs*	*Average Egg Production per Female*	*Labor Income per Female*	*Labor Income per Farm*
Range	*Average Size*				
Under 150	78	$0.364	187	$2.33	$ 182
151–300	199	0.387	168	2.24	418
301–600	379	0.422	173	2.86	1083
Over 600	1256	0.443	201	3.00	3760

Larger flocks benefited four Hawaiian poultrymen[7] in 1948 when their flocks were increased about one-third above those of 1947. The larger flocks in 1948 reduced the hours required per hen, thereby cutting the labor cost from $2.97 to $1.85 per hen. Costs other than feed and labor were cut from $3.85 to $2.65. Lower egg and meat prices reduced the returns and the income per hen somewhat in 1948, but the income per hour worked proved a more important measure of success to these poultrymen (Table 73).

From the records of 13 poultrymen in Hawaii during 1948 (7 on the Island of Hawaii and 6 on the Island of Maui), it was found that income per hour worked ranged from $2.41 to a loss of $0.28. Labor, transportation costs, and overhead were usually lower on the larger farms. These poultrymen were primarily egg producers. A long West Coast maritime strike caused abnormal marketing conditions.

Table 73

	1947	*1948*
Number of hens per flock	846	1232
Management income per hen *	$2.28	$2.08
Income per man-hour and management	$1.47	$1.89
Man-hours per hen	3.8	2.4
Management income per farm	$1929	$2563

* Management income as used in Hawaii and Pacific Coast states is the amount the poultryman receives for his ability as a manager (for use of his head). It is what is left after total expenses (including value of operator's labor, his hands) has been deducted from total income (including eggs and poultry used at home).

Grouping these farms, it was found that the 6 smallest had 340 layers and returned $0.96 per man-hour. The 7 largest farms made $1.27 per man-hour and averaged 1054 layers.

When the 13 Hawaiian farms were divided into the 10 smallest and the 3 largest the influence of size on the income per man-hour was even more pronounced. The 3 largest farms averaged 1628 layers and returned $1.49 per man-hour. The 10 smallest had 454 layers and returned $0.47 less per man-hour, or $1.02.

In central Indiana [8] a survey of 100 laying flocks in 1945–1946 showed that "large returns were associated with large flocks, economy in feeding, production per hen, efficiency in use of labor, low death loss, high ratio of pullets to old hens, early hatching of chicks, and good marketing practices" (Table 74).

Table 74

Size of Flock	*Number of Flocks*	*Returns per Man-Hour*	*Eggs per Hen*	*Man-Hours per Hen*	*Percentage Mortality*
1–120	37	$0 33	154	3.5	15
121–240	50	0.56	148	2.5	10
Over 240	13	1.36	180	2.6	8

Similar relationships occurred in 111 poultry flocks for 1946–1947 in Nova Scotia,[9] except the percentage of production decreased slightly (Table 75).

Table 75

Range in Layers	*Average Number of Layers*	*Number of Flocks*	*Percentage Production*	*Minutes of Labor per 100 Hens*	*Returns per Man-Hour*
Below 250	154	39	55.4	67	$0.49
250–500	369	37	53.0	44	0.70
Over 500	994	35	52.8	32	1.08

A study of 21 poultry farm records in San Bernardino County, California, 1949,[10] showed generally higher management income as size of flock increased. One farm in the 1000–2500 class made minus $2.01 management income per bird, thus throwing that group out of line. High profits were not always accompanied by highest egg production, and little or no relation is shown in these records. Mortality was not affected in this tabulation. A saving in the cost of labor and other costs gave a direct relationship to the net cost per dozen eggs (Table 76).

Table 76

Size of Flock	*Eggs per Layer*	*Man-Hours per Hen*	*Net Cost per Dozen Eggs*	*Percentage Mortality*	*Management Income per Hen*	*Farm Income * per Hen*
Under 1000	196	2.4	$0.509	16.4	$1.46	$2.38
1000–2500	195	2.0	0.480	18.7	0.46	2.22
Over 2500	198	1.5	0.395	17.2	2.20	3.32
10 high-income farms	192	1.5	0.368	17.4	2.48	3.60
10 low-income farms	201	1.9	0.488	16.3	0.42	2.03

* Farm income is total expense (except operator's labor and interest) from total receipts.

In New York State Kearl[11] selected flocks having similar production, 1946 and 1947. The larger flocks in both light and heavy breeds had lower costs, higher returns, and greater profits per dozen eggs (Table 77).

Table 77

	Light Breeds		*Heavy Breeds*	
	Fewer than 850 Layers	*850 Layers and More*	*Fewer than 450 Layers*	*450 Layers and More*
Number of farms	40	37	26	25
Average number of layers	374	1621	283	995
Eggs per layer	174	174	180	180
Percentage mortality	15	16	20	15
Cost per dozen eggs (cents)	55.4	52.8	55.9	51.6
Returns per dozen eggs (cents)	54.2	55.2	50 3	52.4
Profit per dozen eggs (cents)	−0.2	2.4	−5.6	0 8

That the larger flock is likely to be somewhat more efficient has been shown over many years at Cornell University. When flocks were separated on the basis of number of hens, with practically equal numbers

of farms in each of three groups, high to low, the largest flocks were cared for in less time per bird than the small flocks, eggs were produced at lower cost, and the profit was higher (Table 78).

Table 78. Relation of Size of Flock to Cost per Dozen Eggs and Related Factors[12] *Averaged by Thirds, According to Number of Birds, Weighted by Farms*

Group and Number of Farms	Size of Flock	Eggs per Hen	Mortality	Man-Hours per Hen	Cost per Dozen	Profit per Flock
1949–22 Records						
High	2749	203	26	1.3	$0.45	$5337
Medium	1065	169	20	1.1	0.49	157
Low	369	186	28	2.0	0.52	−158
1947–23 Records						
High	2116	193	22	1.4	0.49	2766
Medium	694	184	29	1.7	0.57	345
Low	342	192	15	2.3	0.50	298
1946–23 Records						
High	1680	176	17	1.5	0.46	1978
Medium	704	172	20	1.3	0.42	487
Low	264	191	26	3.2	0.53	−184
1945–28 Records						
High	1653	157	20	1.7	0.42	2027
Medium	800	177	24	1.4	0.41	903
Low	309	177	20	2.7	0.42	151
1944–33 Records						
High	1795	172	22	1.6	0.38	1525
Medium	758	165	23	1.6	0.39	332
Low	256	179	21	2.5	0.50	−342

California is typical of the usual situation. Here, however, records over many years have shown that when the most profitable records are separated they are accompanied by larger flocks, higher egg production, lower mortality, fewer man-hours, and lower costs per dozen eggs (Table 79).

Table 79. Comparison of High-Profit and Low-Profit Groups of Poultry Records in Los Angeles County, California, 1935–1948 inclusive[13]

	High Profit	Low Profit
Number of records	112	113
Average number of hens per flock	1688	985
Eggs per hen	175	156
Percentage mortality	21	28
Man-hours	2.1	2.8
Net cost per dozen	$0.252	$0.35
Management income per dozen	$0.094	$−0.014

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13 · Rate of Production

Rate of production is:

- Not associated with size of flock.
- Sometimes more important than a large flock.
- Related to pounds of feed per dozen eggs.
- Related to costs of feed and total costs per dozen eggs.
- Related to costs of feed per hen.
- Likely to be related to mortality.
- Sometimes accompanied by man-hours per hen.
- Related to farm income, labor income, and profit per hen.
- Related to income from eggs.
- One of the most important factors influencing profits, so much so that, when studying the importance of other factors, results may be distorted unless farms with similar rates of production are selected.

It has been pointed out that the size of flock is not necessarily related to eggs per hen. It is an advantage to aim for high production regardless of the flock size and, if it is reached and combined with large flocks, results should be more favorable. Large flocks, important as they are in size of labor income or profit, will not always overcome a lower rate of production. Should a large flock with a low rate of production result in a loss per bird, the outcome might be disastrous. On the other hand, a high rate of production per bird with a small-sized flock could return a favorable labor income or profit per bird, but a small total figure, when the total labor income or profit would be dependent upon the size of the flock.

On 153 poultry farms in New York State,[1] surveyed during 1946–1947, light-breed flocks were divided into three groups, each with about 2 dozen eggs per layer less than the next higher group. A larger flock in the group with low production was handicapped and lost money. The adverse effect of only 152 eggs per layer under the conditions prevailing on these farms is seen in Table 80. As production rose, the profit per dozen eggs and per farm increased tremendously.

As production per layer increases, costs tend to increase. More feed is required, chicks of higher quality and at higher cost may be needed, and the increased number of eggs calls for more labor in gathering and preparing for market. More containers must be supplied, and greater

Table 80

Production per Layer	*Profit per Dozen Eggs*	*Profit per Farm*	*Number of Layers*
152	\$−0.025	\$−396	1252
178	0.038	576	1022
203	0.077	1310	1006

total costs of shipment must be met. These extra costs are not likely to increase in the same proportion as the returns.

Labor, equipment, and building costs increase less rapidly than production. Feed per dozen eggs should be lower. The largest amount of the feed consumed is used for maintenance. Very little extra is needed for the production of eggs. Hence, as the rate of production increases, the amount of feed required per dozen eggs decreases. Darrah [2] showed this relation from his survey of 120 poultry farms in 1940–1941 (Table 81).

Table 81

Average Number of Eggs per Layer	*Amount of Feed Used per Dozen Eggs (Pounds)*
140	8.0
160	7.3
180	7.0
200	6.3

Culling regularly cuts the feed cost and raises the rate of production per layer. The extra labor cost of culling each 2 weeks or every month is likely to be more than offset by savings in feed.

Higher production obtained with little or no extra cost is important, but there are factors limiting increased yields, all of which are not controlled 100 per cent. The chance of heavier losses, due to unfavorable environment or management conditions, is greater in flocks producing heavily than in those of lower production. All layers are unfavorably affected by a failure of the water supply, artificial lights during the lighting period, temporary insufficient feed, very high temperatures, or heavy lice or mite infestation, but the loss may be greater among high egg producers. For uninterrupted high performance, conditions must continue to be favorable. Heavy producers may recuperate fairly quickly when conditions are corrected, but in the meantime a reduction in eggs may continue for several days or weeks. Mistakes are, therefore, likely to be more costly as production per bird goes higher.

The desirability of high production combined with good management is shown in results from California.[3] These results are from 112 records

of all cooperating poultrymen for 19 years, 1929–1947. Farm income increased as production per hen increased, even when the flock size was less. Higher production was associated with lower mortality. In the 125–150 and 150–175 egg groups averaging the same number of birds and man-hours per hen, an increased number of eggs was associated with nearly twice the farm income.

More time was used per hen in the higher production flocks. Apparently, on these farms a lower labor charge did not offset low production. Apparently, also, the higher production requiring more hours per hen paid well. The group averaging over 200 eggs per hen made a higher total farm income and $0.939 farm income per hour. This is $0.351 more than the 150-egg group, which had more hens, and a farm income of $0.588 per hour (Table 82).

Table 82

Eggs per Hen	*Farm Income per Ranch*	*Average Number of Hens*	*Percentage Mortality*	*Man-Hours per Hen*	*Farm Income per Hour*	*Number of Records*
Below 125	$ 567	1668	37.5	1.8	$0.189	32
125–150	1147	1416	32.0	2.3	0.352	115
150–175	2074	1411	25.8	2.5	0.588	153
175–200	2750	1382	22.7	2.7	0.737	81
Over 200	3248	1116	16.5	3.1	0.939	31

Records from 41 Washington State poultrymen [4] in 1946 indicate no variation in egg production due to size of flock, but a definite relation between eggs produced per bird and labor income per bird.

Eggs per Bird	*Labor Income per Bird*
179 or less	$1.94
180–189	2.22
190–199	2.50
200 and over	3.28

In Pennsylvania, 32 cost-account records showed that profit per layer improved as the production capacity of flocks increased.[5] The net return per layer increased from $0.20 when production was under 174 eggs per bird to $1.63 when the average was more than 200 eggs.

Similar relationships are shown from several hundred records in South Carolina and Missouri. Better production is accompanied by higher feed cost per hen, larger sized flocks, and higher labor income per hen in South Carolina.[6] In Missouri, as production per hen increased from 100 to 200 eggs per hen, both the income from eggs and total income per hen increased about two and one-half times.[7]

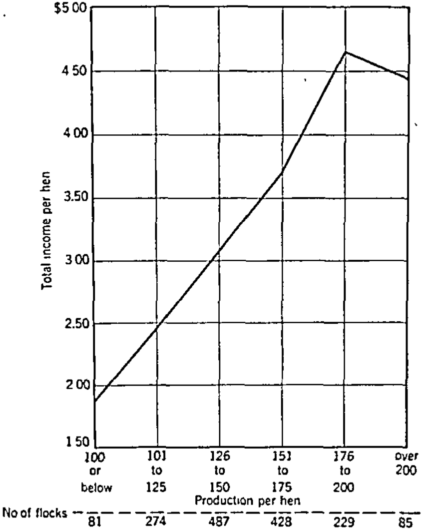

Fig. 81. Relation of production per hen to total income per hen.[7] More eggs per hen means higher income. (*Source: 1584 Missouri poultry records,* 1934–1945.)

The relation of egg production per hen to labor income per hen on a large number of farms in South Carolina, 1928–1946,[8] is shown in Table 83.

Table 83

Production per Hen	*Number of Flocks*	*Size of Flock*	*Feed Cost per Hen*	*Labor Income per Hen*
100 or below	193	102	$1.73	$1.13
100–150	670	220	2.40	2.08
Over 150	662	324	2.78	2.19

Insofar as *mortality* may have an influence on returns, a low mortality appears desirable and is associated with high rate of production on 172 New York State farms reported by Kearl. Low production denotes

low-quality stock or some factor that, through accident or mismanagement, has lowered the productive capacity of the flock. On these farms lower production is accompanied by higher mortality. The farms were sorted for high to low number of eggs per hen and were divided into 10 groups. Although mortality is related, the average number of layers or the time required to do the job show no trend (Table 84).

*Table 84. Relation of Production to Mortality and Number of Layers, 172 New York State Farms, 1946–1947 **

Eggs per Layer	*Average Percentage Mortality*	*Average Number of of Layers*	*Man-Hours per Layer*
224	12	766	2.6
208	14	771	2.9
197	15	886	2.1
187	17	861	2.6
179	15	1158	2.1
173	18	619	2.9
165	16	1536	1.8
154	18	815	2.8
131	21	899	2.6
110	20	871	2.4

* Courtesy of C.D. Kearl, Department of Agricultural Economics, Cornell University, 1950.

Law of Diminishing Returns

In other fields, after production has increased to certain points, the extra costs of securing additional increases are too great to be profitable. This point is not known with poultry. As the size of a poultry flock becomes larger, the opportunity for cutting costs per bird increases. Advances in breeding, nutrition, disease control, and management have combined to produce birds of exceptional hardiness and productive powers, which enable them to withstand many unfavorable conditions and produce well. There is some evidence that the eggs of our present-day birds highly bred for production are of reduced interior quality and that special progeny test breeding and selection is needed to combine high production and high interior quality, especially albumen condition.

Rather than cease efforts, poultrymen should continue to feed and otherwise manage the best practical quality stock available and strive for high average yields. Within limits, returns increase more rapidly than costs.

High production is always important but is especially so with large flocks, as total costs of feed and labor are likely to be higher.

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14 · Light Breeds vs. Heavy Breeds in Egg Production

In New York State since 1940, light breeds have shown themselves better money makers than heavy breeds when egg production is the main enterprise.

Heavy breeds sold in New York State average about 1½ pounds heavier per layer than light breeds.

Mortality among both light and heavy breeds is decreasing in New York State.

Production and feed per layer among both light and heavy breeds are increasing in New York State.

In Kansas in 1941, heavy breeds returned a higher labor income but a smaller return per man-hour for each 100 layers.

In Iowa in 1941, Leghorns returned more per hen than heavies and larger flocks of Leghorns were kept.

Both Indiana and Pennsylvania show greater profit per layer with light breeds, 1948 and 1947.

Heavy breeds were more remunerative in South Carolina in 11 years out of 20 from 1928 to 1947, because of larger broiler sales and heavier cull hens. From 1945 to 1947 in South Carolina light breeds made higher labor incomes.

Factors in selecting a breed may include:

- Use: whether for market or hatching eggs, for meat, or for eggs and meat.
- Probable profit resulting from: production ability; and price spread of eggs or chicks.
- Availability of desired stock.
- Personal likes or dislikes for a variety or a type of enterprise.

In two surveys involving 120 New York State poultry farms in 1940–1941, and 172 poultry farms in 1946–1947, light breeds have consistently returned more for each man-hour and profit per layer in the production of market eggs. In 1946–1947 (Table 85) the costs for each dozen eggs was $0.01 less for the heavy breeds. The returns per dozen eggs were $0.035 less, resulting in a profit per dozen of $0.004 for the heavy breeds and $0.029 for the light breeds, or $0.025 in favor of light breeds.

The differential between white and brown eggs was $0.037 per dozen in favor of white eggs. Labor cost $0.01 more per dozen for brown eggs. Other returns, including that from a heavier meat carcass were slightly larger with heavy breeds.

The effect of production on costs per dozen eggs is shown in the combined results from 135 farms in New York State for 1946–1947

Table 85. Costs and Returns per Dozen Eggs,[1] 172 New York Farms, 1946–1947

	Light Breeds		*Heavy Breeds*	
Number of farms	82		53	
Average number of layers	1095		614	
Eggs per layer	175		179	
Costs per dozen eggs				
Feed	31.0¢	59.1%	31.9¢	62.1%
Labor	8.6	16.4	9.6	18.7
Buildings and equipment	3.4	6.5	3.8	7.4
Depreciation	6.6	12.6	2.5	4.8
Other	2.8	5.4	3.6	7.0
Total	52.4¢	100.0%	51.4¢	100.0%
Returns per dozen eggs				
Eggs	54.9¢	99.3%	51.2¢	98.8%
Other	0.4	0.7	0.6	1.2
Total	55.3¢	100.0%	51.8¢	100.0%
Profit per dozen eggs	2.9		0.4	
Net cost per dozen eggs	52.0		50.8	

Table 86. Relation of Eggs per Layer to Costs and Returns per Dozen Eggs by Breeds,[1] 135 New York Farms, 1946–1947

	Light Breeds			*Heavy Breeds*		
	Low Production	*Medium Production*	*High Production*	*Low Production*	*Medium Production*	*High Production*
Number of farms	28	27	27	18	18	17
Average number of layers	1252	1022	1006	604	609	629
Percentage mortality	13	17	15	21	13	15
Feed per dozen eggs (pounds)	8.3	7.2	6.8	9.6	7.6	6.7
Eggs per layer	152	178	203	137	168	218
Costs per dozen eggs (cents)						
Feed	34.8	29.9	28.3	39.8	31.3	27.3
Labor	9.2	8.9	7.7	11.9	8.4	9.1
Buildings and equipment	3.8	3.6	2.8	3.6	4.2	3.5
Depreciation	6.9	6.1	6.9	2.3	2.9	2.3
Other	2.8	2.9	2.6	4.2	3.6	3.5
Total	57.5	51.4	48.3	61.8	50.4	45.7
Returns per dozen eggs (cents)						
Eggs	54.7	54.4	55.7	51.1	51.4	51.2
Other	0.2	0.4	0.3	0.6	0.6	0.5
Total	54.9	54.8	56.0	51.7	52.0	51.7
Profit per dozen eggs	−2.5	3.4	7.7	−10.1	1.6	6.0
Net cost per dozen eggs	57.3	51.0	48.0	61.2	49.8	45.2

when they were grouped according to low, medium, and high number of eggs per layer (Table 86). As production increased in both light and heavy breeds the pounds of feed per dozen eggs and costs per dozen with which feed is closely associated decreased. Production did not affect mortality except in the low-production heavy breeds where it was 21 per cent.

Production had a very considerable effect on the cost of feed for each dozen eggs. The difference of $0.065 in favor of high production with light breeds and $0.125 with heavy breeds was similar to receiving that much more per dozen on the market and was instrumental in returning $0.102 more per dozen with light breeds and $0.161 more with heavy breeds.

Heavy breeds compared quite favorably with light breeds in feed cost per dozen and in mortality of the better laying flocks. The flocks of heavies were smaller, which may have raised the labor cost per dozen somewhat, as the volume of eggs would be less. Depreciation costs were lower with the heavies. This resulted in the production of eggs at $0.028 less per dozen with the high-producing heavy breeds than with the best light-breed flocks. This did not however entirely offset the higher returns.

In New York State white-shelled eggs are favored, and in flocks producing them the differential varied several cents.

There are two methods of receiving greater net returns per dozen eggs: first, reducing the cost, and second, marketing at a higher price. A $0.01 gain made on each means a net gain of $0.02.

On 91 New York State farms during 1940–1941 the net cost of producing a dozen eggs was $0.042 greater with heavy breeds, largely due to more feed, extra labor, and automobile, truck, and building charges. The return for a dozen eggs with heavy breeds was about $0.01 higher. This extra price received for heavy-breed eggs was ascribable to some retail deliveries and hatching-egg sales and was practically offset by the extra labor costs involved.

The gross costs were $0 046 greater for the heavy breeds, and the total returns $0.015 greater, resulting in an advantage of $0.031 for each dozen eggs in favor of light breeds. Heavy breeds lost $0.006 per dozen, and light breeds gained $0.025 per dozen.[2]

Both light and heavy breeds showed improvement in net gain during the 6 years between the two New York surveys. The 1940–1941 survey ended September 30, 1941, and the 1946–1947 survey ended August 30, 1947. The intervening period had seen an advance in the general price level from an index of 128 in 1941 to 222 in 1947. This favorable situation was shown in the price for eggs and in the advance in costs of things the poultrymen had to buy.

Prices for eggs advanced more rapidly than costs. Heavy breeds produced eggs at lower cost than light breeds in 1946–1947, but the selling price differential was a handicap. The net result showed heavy breeds producing eggs at a slight profit in 1946–1947, but less than with light breeds (Table 87).

Table 87

	Light Breeds	*Heavy Breeds*
Net cost of producing eggs, 1946–1947	\$0.520	\$0.508
Net cost of producing eggs, 1940–1941	0.263	0.305
Net increase in cost	\$0.257	\$0.203
Returns for each dozen eggs, 1946–1947	0.549	0.512
Returns for each dozen eggs, 1940–1941	0.288	0.299
Net increase in price	0.261	0.213
Net gain per dozen in 6 years	\$0.004	\$0.010

Better management, as well as a favorable price level, is evident in the comparison of factors between 1940–1941 and 1946–1947. Layers laid better, were heavier, ate more feed, and fewer died; and poultrymen took care of eggs in less time in the later year. Eggs brought better prices, costs were higher, but profits per dozen eggs were greater also, all of which raised the hourly return and the profit per layer. See Table 88.

Table 88. Comparison of Light and Heavy Breeds in New York State, 1940–1941 and 1946–1947

	1946–1947[1]		1940–1941[2]	
	Light Breeds	*Heavy Breeds*	*Light Breeds*	*Heavy Breeds*
Number of farms	82	53	80	40
Average number of layers	1095	614	1369	838
Egg production per layer	175	179	168	167
Mortality	15%	16%	26.5%	20.6%
Pounds of feed per layer	109	117	95	108
Pounds of feed per dozen eggs	7.2	7.5	6.9	7.9
Man-hours per layer	2.0 hr.	2.3 hr.	2.2 hr.	2.6 hr.
Man-hours per dozen eggs	8.2 min.	9.1 min.	9.5 min.	11.2 min.
Live weight per layer sold	4.5 lb.	6.1 lb.	4.2 lb.	5.8 lb.
Number of farms	—	—	61 *	27 *
Average number of layers	—	—	1104	1051
Egg production per layer	—	—	171	168
Returns per dozen eggs	\$0.549	\$0.512	\$0.288	\$0.299
Net cost of producing a dozen eggs	0.52	0.508	0.263	0.305
Profit per dozen eggs	0.029	0.004	0.025	–0.006
Return per man-hour	0.84	0.65	0.533	0.337
Profit per layer	0.43	0.06	0.35	–0.08

* These farms include flocks of 500–2400 birds only.

On 71 Kansas farms in 1941, Hoecker found light-breed flocks averaged nearly twice the size of heavy-breed flocks.[3] Therefore, comparisons are made on the basis of 100 hens (Table 89). The labor disadvantage of the general-purpose flocks was caused by rearing more chicks per 100 hens, and, because of smaller general-purpose flocks, a larger time requirement.

Table 89

	Light Breeds	*General-Purpose Breeds*
Number of enterprises	33	38
Capital invested		
Flock	$111.00	$144.00
Buildings and equipment	205.00	207.00
Labor per day (including rearing)	1 hr.	1.8 hr.*
Returns from sales	$398.38	$417.07
Total receipts	409.54	455.82
Total expenses	233.76	251.14
Poultry labor income	156.82	183.20
Returns per hour	0.42	0.28

* Includes both rearing and laying flocks.

A higher labor income on general-purpose breeds accrued to the operators. Three-fourths of an hour more labor was required. Returns for each man-hour was in favor of the light breeds. The price for market and hatching eggs was the same, but the value of birds sold was considerably higher for heavy-breed poultry.

From demonstration records by Whitfield in Iowa,[4] Leghorns appear to have a slight advantage financially and in time. The higher egg production per bird with Leghorns was partially offset by a higher mortality. However, the smaller-sized flocks of heavies required more labor per bird and more feed per dozen eggs. This was offset largely by higher receipts per hen in market poultry, hatching eggs and breeding stock sold. The net result appears to be somewhat more work for a slightly lower return (Table 90).

Table 90

	Leghorns	*Heavies* *
Number of farms	10	12
Average size of flock	428	187
Average number of eggs per hen	162	138
Percentage mortality	22	19
Man-hours per hen	1.1	1.4
Pounds of feed per dozen eggs	6.3	8.9
Labor income per hen	$2.30	$2.26

* Heavy breeds consisted of Buff Orpingtons, White Rocks, White Wyandottes, New Hampshires, Austra-White, Barred Rocks, Rhode Island Reds.

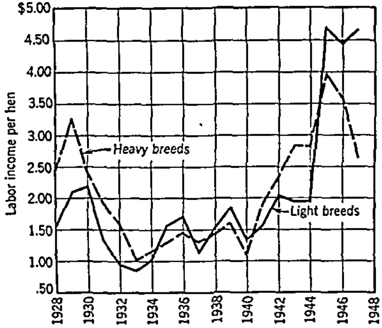

Fig. 82. *Comparison of labor income per hen for light and heavy breeds, South Carolina.* Heavy breeds have paid well in South Carolina. (*Source: 20 years' study of poultry records,* 1928–1947.)

An analysis of 32 poultry accounts by Hawthorne and Miller in Pennsylvania [5] shows a difference of \$0.80 profit per layer and \$0.033 per dozen eggs in favor of light breeds over heavies. Sicer of Indiana [6] finds higher egg production, larger flocks, lower feed cost, higher price per dozen eggs and higher labor income per female among 18 light-breed flocks than 49 heavy-breed flocks in 1947–1948.

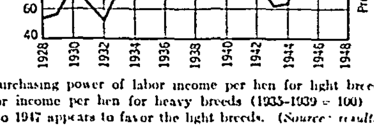

Fig. 83. Purchasing power of labor income per hen for light breeds in terms of the labor income per hen for heavy breeds (1935–1939 = 100). The trend from 1941 to 1947 appears to favor the light breeds. (*Source: results from 1312 poultry records in South Carolina, 1928–1947, inclusive.*)

Poultry farms in central Indiana [7] showed from a survey in 1945–1946 that "Leghorn laying flocks usually were somewhat larger than heavy breed flocks, produced more eggs per hen, and made a greater return to labor."

Gooding reports in a study of 1319 poultry records in South Carolina,[8] extending over a period of 20 years, 1928–1947, that heavy breeds proved slightly more remunerative, due mainly to larger broiler sales and heavier cull hens (2–4 pounds heavier than light-breed hens and bringing \$0.03–\$0.05 more per pound). Higher egg production from light breeds could not make up the difference. Light breeds derived 83 per cent of their income from eggs. The heavy breeds returned 62 per cent from eggs. For 20 years light breeds averaged 218 hens per farm and heavy breeds 103. Eggs per hen were 153 and 123, respectively.

Out of the 20 years, light breeds returned higher labor incomes per layer in 8, and higher purchasing power of labor incomes in terms of those from heavy breeds in 7 years of the 20. The trend from 1944 to 1947 appears to favor light breeds.

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15 . Labor Efficiency

Labor efficiency on poultry farms may be accomplished by:

1. *Placing more birds together.* Removing partitions simplifies operations. Egg production or mortality is not affected. Cleaning, feeding, and watering may be more readily accomplished. It is easier, with Leghorns, to move among the birds. Grouping nests is more possible.
2. *Caring for more layers with the same or less labor.*
3. *Economizing in feeding.*
   - Feed source near or in pens.
   - Carriers or feed chutes to reduce walking time.
   - Elevator.
   - Double swinging doors.
   - Automatic feeders.
   - Method of feeding.
4. *Reducing number of times pens are cleaned.*
   - Built-up litter.
   - Use old litter.
   - Eliminate droppings boards or pits.
5. *Improving equipment.*
   - Watering, automatic
     - Running water.
     - Float valve.
     - Cone fountains.
     - Electric heating cable.
     - Water warmers.
6. *Using large-capacity feeders.*
   - Eight inches deep and 8 inches wide for layers and growing pullets after 8–10 weeks.
   - No waste, fill to 2 inches from top.
   - Less filling.
7. *Arranging feeders for quick service.*
   - This is a small saving usually, but only a short time is required to make the change.
8. *Grouping nests near entrance.*
   - Nest rooms.
   - Individual nests together.
9. *Placing light switches and thermostats near doors.*
10. *Reducing chore time.*
11. *Reducing egg cleaning and sizing time.*
    - Egg room near egg source.

Organize to avoid extra trips from the dwelling for cleaning, sizing, and packing.
Use mechanical devices.
Watch the quality factors.

12. *Organizing better annual labor distribution.*
Seasonal hatching.
13. *Planning operations at least one year ahead.*

Labor is the second- or third-highest cost of egg production, feed being the first. A small flock may be nearly as efficient in use of labor as a large flock if only the necessary time needed is charged. However, the time required to do certain necessary walking takes as long in both cases. Therefore, the smaller flock is likely to be less efficient in use of labor. Because one can care for a larger flock in less time per bird than for a small flock, assuming the layout is efficient, and with somewhat less equipment and investment per hen, costs of production are likely to be lower with the large flock.

Professor F. D. Reed, University of Maine Extension Service, observes that "labor efficiency is not an end in itself and size alone is not a criterion of production efficiency.··· The true measure of efficiency is the cost of producing a dozen eggs or pound of poultry meat."

Higher production per layer calls for more labor in collecting and preparing eggs for market, but the total labor required by the flock and caring for the larger number of eggs increases less rapidly than the advantages from the greater number of salable eggs. Therefore, rate of production becomes of considerable consequence.

Labor efficiency means using labor to accomplish the same or better results in less time or in an easier or less fatiguing manner. It may call for investment in improved equipment, larger pens, central laying quarters or conveniences in preparing eggs for market.

Larger flocks can be cared for more efficiently than smaller flocks. A survey of 172 farms in New York State in 1946–1947, averaging from 200 to 3000 layers, showed that as flocks become smaller than 800–900 more time is required to care for a layer[1] (Table 91). The saving in labor did not appear to be an important factor as the flock became larger on these farms. However, the opportunity of accomplishing work in less time on many poultry farms is evident from a study of individual farms, including the organization of plant layouts and the methods used.

Hen accounts from cost-account farms in New York State summarized by the Cornell University Department of Agricultural Economics show for 1945–1949 fewer man-hours per layer on larger flocks in most instances. Although variations occur, in general, as flocks become larger the man-hours per layer become smaller.

Table 91

Average Number of Layers	*Man-Hours per Layer*
2781	1.7
1369	2.1
1136	2.0
941	1.8
807	2.0
635	2.5
500	3.0
419	3.0
320	3.4
193	3.5

In Table 92 the flocks are averaged by thirds according to number of birds, and weighted by farms. The smallest third of the flocks in each

Table 92 *

		Largest and Smallest Flocks		*All Flocks, Range in Man-Hours per Hen*
Size of Flock	*Man-Hours per Hen*	*Size*	*Man-Hours per Hen*	
		28 Accounts for 1945		
1653	1.7	2979	1.2	
800	1.4			0.86 to 3.9
309	2.6	158	1.8	
		23 Accounts for 1946		
1680	1.5	2894	1.2	
704	1.3			1.02 to 6.4
264	3.2	161	2.8	
		23 Accounts for 1947		
2116	1.4	3941	0 76	
694	1.7			0.76 to 3 53
342	2.3	230	3 5	
		23 Accounts for 1948		
2131	1.3	4018	0 7	
807	1.7			0 73 to 3.5
296	2.2	111	1 1	
		22 Accounts for 1949		
2749	1.3	5255	0 7	
1065	1.1			0.71 to 3 37
369	2.0	208	1.7	

* Arranged from "Individual Factors and Annual Averages from Farm Cost Accounts" for 1945, 1946, 1947, 1948, 1949, Department of Agricultural Economics, Cornell University.

year used more labor per bird. Flocks of 800 and more show a less pronounced break, and in 1945 and 1946 the flocks in the largest third required more labor per hen than the flocks averaging 700–800 hens. The largest flock in each year is low in man-hours per hen. The range in each year is considerable.

Labor efficiency may be measured in several ways. The more important ways are:

1. Amount of time required to do various jobs.
2. Number of layers per man.

"Dozen eggs per man" is a factor dependent upon the rate of production and the number of birds involved and, though a measure, may be less dependable.

"Production man work units per man" is a figure better used on the farm as a whole for the various kinds of stock or crops to measure the strength or weakness of each. It is especially important in farm reorganization work. On specialized poultry farms producing various kinds of poultry products it provides a measure of labor efficiency.

Chores

Opinions concerning the work included under chores may vary somewhat. In general, an agreement is likely that chores consist of feeding, watering, gathering eggs and getting them to the egg room, and any other routine work done in the chicken houses. There are numerous jobs under the main headings, which may differ considerably on various farms. Bressler[2] has listed the jobs which he included under chores. He decided that travel between the dwelling and laying house should not be included in making chore comparisons, because distances traveled are not always alike, houses cannot always be moved, and often an operator may go from another building or a field to the poultry house.

> Operations common to the job of feeding were as follows: travel between houses, on stairway or elevator, between pens, to feed bin or chute, between chute and hopper, between hoppers, to get feed bucket, to fill feed bucket, to fill hoppers or scatter feed, to stir feed, to open feed bags, and to fill feed bins. Operations for the job of watering included travel between houses, on stairway or elevator, between pens, between faucet and fountain, between fountains, to empty waste water, to get water bucket, to fill water bucket, to clean fountain, to fill fountain, to turn spigot on and off and to thaw pipes. Operations for gathering eggs were travel between houses, on stairway or elevator, between pens, to and from nests, between nests, to get egg baskets, to collect eggs in nests, to collect floor eggs, to egg cellar, and to record production. Miscellaneous operations included examining sick bird, disposing of dead bird, opening and closing windows, turning lights on and off, and repairing equipment.[3]

The jobs of watering, feeding, and collecting eggs occupy a good share of the chore time on a poultry farm. The work with eggs, including both collecting and preparing eggs for market, may take the most time on many farms. Eggs are the end product, and the return per dozen depends not only on the prices at which eggs sell in the market but also on how well the eggs from any farm will meet the requirements for that price. Although this labor appears to be essential, labor-saving equipment and systematic care should reduce the time for that work.

A study by Kearl [1] of Cornell on 170 New York State farms in 1946–1947 provides a cross section of the labor required for doing the chores, cleaning the buildings, handling eggs, and the like. About half of the time was required for chores. Chores probably included gathering eggs. The next largest amount of time was in handling or preparing eggs for market (Table 93).

Table 93

	Labor per Layer			*Labor per Dozen Eggs*		
	Light Breeds (hours)	*Heavy Breeds (hours)*	*All Farms (hours)*	*Light Breeds (minutes)*	*Heavy Breeds (minutes)*	*All Farms (minutes)*
Chores	1.0	1.3	1.1	4.3	5.2	4.6
Cleaning buildings	0.1	0.2	0.1	0.5	0.7	0.6
Handling eggs	0.8	0.7	0.8	3.1	2.9	3.2
Other	0.1	0.1	0.1	0.3	0.3	0.3
Total	2.0	2.3	2.1	8.2	9.1	8.7

Earle [2] made time and travel studies on 15 New York State poultry flocks varying in size from 300 to 2430 layers. "There was a slight tendency for farms with over 1000 hens to use less time on the daily chores and more time on other poultry work." Records were taken in Wayne and Monroe counties during October and November, 1946, and again in January and February, 1947. To obtain comparable results, all data were standardized on the basis of 1000 hens.

A summary of 13 of the farms shows gathering and carrying eggs to the egg room consumed about 33 per cent of the daily chores, feeding 30 per cent, walking in and between pens and houses 17 per cent, and watering 16 per cent. The data shown in Table 94 are averages for 13 farms for 1 year on the basis of 1000 hens.

There are many opportunities for cutting these chore costs. The time required varies with the methods used. When one compares farms, extra trips may offset the time saved by rearranging feeders, improving waterers, and the like. On one farm extra trips may be made for wet mash or pellet feeding or in applying other means for stimulating feed consumption. On another farm feed may be "free choice," with feeders being filled twice or three times a week only; and

here chores may consist of 2 trips daily: opening nests in the morning, closing them at night, checking the water, adjusting windows, curtains, or ventilators, and looking the flock over while passing through as most

Table 94

Jobs	*Average Number of Hours Used*	*Average Number of Miles Traveled*
Feeding		
Dry mash	59	43
Wet mash	4	2
Pellets	14	9
Grain	55	47
Milk	9	4
Totals	141	105
Watering	76	50
Gathering eggs	149	63
Carrying eggs	8	11
Waiting	12	—
Walking between buildings	64	146
Walking between floors	16	14
Total other jobs	10	5
Total	476	394

poultrymen do. On one farm all the same things may be done as on another, and, in addition, water receptacles may be cleaned or perhaps water carried, and extra trips made for feeding.

Even with extensive rearrangement, any real saving in labor will depend on the procedures followed by the individual operator and how he decides the work should be done.

Policies or methods of giving the care thought necessary by the operator should not be changed until he is convinced that another method is just as desirable or better. Organization of the work, however, so long as methods are not disturbed, can often be improved and time saved thereby.

On 12 New Hampshire commercial poultry farms [4] selected for efficiency the time used to do the daily chores of feeding, watering, and collecting eggs varied from 47 to 121 minutes per 1000 layers. The average time was 87 minutes The chore time varied per 1000 hens from 21 to 110 minutes and the distance traveled from 1613 feet to 7746 feet per day on 8 farms in central New York, 1944.[5] The chores in the New York study included watering, feeding, gathering eggs and carrying

them to the egg cellar. No pen cleaning was included. Water was piped to all pens.

An example of time saving may be illustrated by a record taken for one day in early July 1951 on a New York State poultry flock. Laying quarters, equipment, and flocks consisted of:

(*a*) Second floor, remodeled barn; laying room with 1 pan automatic water container and 4 cone-shaped automatic waterers, all protected by

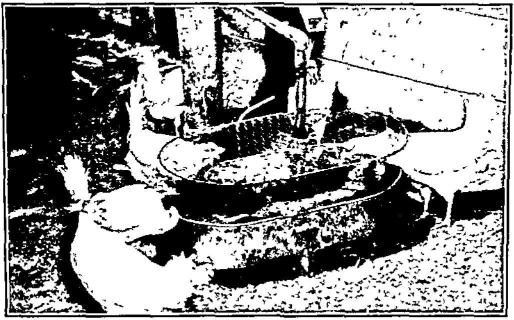

Fig. 84. A watering device that reduces water throwing. Heavy endless wire is hung above waterers, covered with poultry netting, and suspended on wire, *which permits the guard to swing. Layers will not fly onto this guard, nor* will they get into the pan nor on the edge when the guard is hung about 6 inches above the waterers. The bird does most of its drinking without removing its head, lifting it very high, or rubbing its comb against the wire. The drip pan is connected with a drain and is removable *for cleaning. Electric heating cable* on the pipe is protected from wear due to movement of the wire guard.

electric heating cable; 926 pullets hatched November 28, 1950; 588 eggs.

(*b*) First floor, same barn; similarly equipped but with 2 cone-shaped waterers; 266 hens hatched February 1949; 97 eggs.

(*c*) Brooder and barracks quarters; 3 cone waterers and laying room; 150 hens hatched December 1949; 245 eggs.

Feeding was free choice or cafeteria style; hoppers were filled two or three times weekly. No feeding was done on the day the record was taken. The barn was 75 feet from the egg-room cellar in the dwelling house. Brooder (barracks) was 60 feet from the barn. (Eggs are cleaned and sorted for size the day they are gathered and are packed

Fig. 85A.

Fig. 85B.

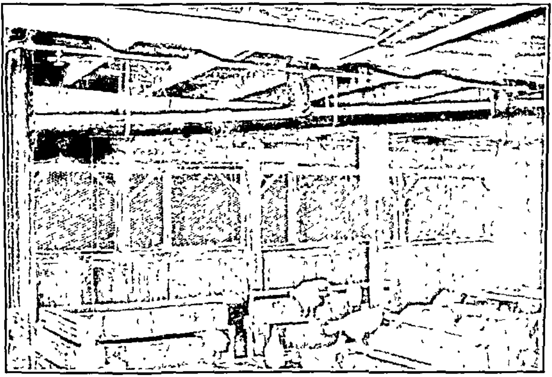

Fig. 85*C*.

Fig. 85*A*, *B*, *C*. Discarded grills with poultry netting flat across the bottom hung above cone waterers *in tile drains to reduce water throwing* *Each waterer* is connected to a common drain at the ceiling of the pen below (*C*). Five waterers service 950 laying pullets.

the following morning.) The time for chores started at the dwelling and ended at the egg room and included all walking. Chores consisted of collecting eggs four times, picking up floor eggs, feeding cats, and disposing of a dead pullet. Eggs were cleaned and sized once after the *fourth collection, and this operation included preparing washer and* sizer, and replacing eggs in baskets and in the egg room for overnight cooling.

The flock comprised 716 hens and 926 pullets. Total eggs gathered were 930.

	Minutes
Chores	102
Packing	40
Cleaning and sizing 930 eggs	90
Total	232, or 3 hours, 52 minutes

Mechanical Feeders

Bressler [2] found that an average of 12 per cent of the daily chore time and travel was used for the total feeding job and about 12 per cent of that time for feeding mash, on 12 poultry farms studied. This led to

Table 95. Mechanically Fed vs. Hand-Fed Layers; Comparison of Feed Consumption per 100 Chicken Days, and Percentage Egg Production, November 4, 1947–June 1, 1948

Group	Mash	Scratch	Pellets	Semi-Solid Buttermilk	Total Pounds	Percentage Egg Production
Hamp-Rock pullets						
Hand fed	13.93	16.53	2.94	0.27	33.68	60.1
Mechanically fed	16.71	16.10	0.00	0.00	32.81	60.4
New Hampshire pullets						
Hand fed	14.21	15.64	2.79	0.25	32.89	56.5
Mechanically fed	15.67	15.64	0.00	0.00	31.32	59.3

Fig 86. Automatic feeder used in rearrangement of a 106′ Pennsylvania laying pen is 64′ long, controlled by a time clock, and open 5 minutes at ½-hour intervals. Unused mash was returned to the feed bin at the far end and mixed automatically with fresh mash each time the feeder operated. Time and distance from November to December was cut in half Only 0.7 minutes per day per 1000 layers was required. Filling the feed box every third day was the only work. (*Courtesy G O Bressler.*)

tests with mechanical feeders. It was thought that the movement of mash might stimulate mash consumption and thus reduce or eliminate extra trips for feeding wet mash or pellets on many farms. Table 95 shows data on pens of layers receiving like care "with respect to litter, ventilation, watering, illumination, and egg gathering." The mechanically fed layers received a fresh supply of mash automatically at 1-hour intervals throughout a 13-hour day. Hand-fed layers received a 1-day supply of mash in hoppers about 8 A.M. They also received pellets and semi-solid buttermilk most of the time.

Total feed consumption was similar and substantiated the original idea. There was no significant difference in weight or mortality.

Bressler's farm tests included on one farm removing the partitions in the second story of one building, installing an automatic mash feeder to replace hand feeding of mash and pellets, and moving nests to one end directly over the storage room in the basement (Fig. 87).

The mechanical feeder calls for considerable investment. Bressler's observations were that the hopper can be filled at convenient times every 2 or 3 days or daily; no special trip is required to feed mash; less mash is wasted than in conventional hoppers; layers had fresh mash every half hour; less feeder space is required; and the longer the feeder and the more birds it services, the less will be the investment per bird. He concludes such a feeder would not be practical for less than 800 layers on the basis of assumed costs. The life of the feeder is estimated at 10 years.

Net cost of the feeder used on one of the farms in the Bressler study and for 10 years, on the basis of 1000 hens:

Cost of mechanical feeder, estimated and actual, over a 10-year period, and installation	$244.55
Interest for 10 years	61.14
Repairs	60.00
Insurance	26.90
Operation costs	60 00
Total	$452.59
This amount is in excess of other feeders it would have been necessary to purchase otherwise which, with interest and repairs, would total for 10 years	108.75
Net cost of mechanical feeder	$343 84
The feeder saved 9.19 minutes daily, or 559 06 hours in 10 years @ $0.65 per hour	363 39
Net savings over 10-year period	$19 55

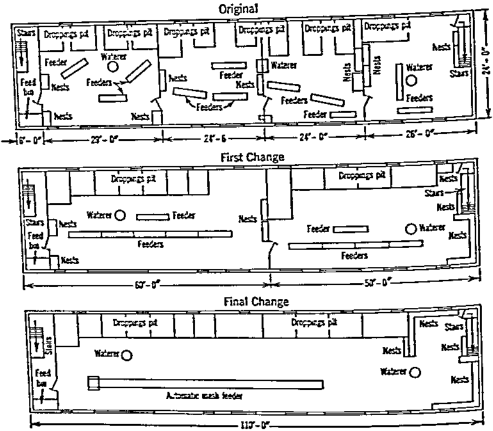

FIG. 87. *Original.* Poultry-house floor of 4 pens, latch doors between pens. Sectional, metal, and community nests are located in several places and pan float-valve waterers in the end pens, with one waterer servicing the two center pens. *First Change.* Two partitions are removed, nests are placed in central locations near doorways; the large central waterer is removed and feeders are placed end to end, parallel to the front wall. Mash feeding time has been cut one-third. *Final Change.* Center partition is removed, nests are placed at one end of the 101' laying pen, and an automatic mash feeder has replaced the hand feeding of mash and pellets. (*Drawing courtesy G. O. Bressler.*)

Bressler concludes: "The small net savings of \$19.55 for the 10-year period emphasized the importance once again of making a careful study of labor-saving equipment before making a large cash outlay."

In spite of mechanical problems and cost many automatic feeders are being installed and used largely because of their convenience and saving of human energy. However, at this writing some poultrymen have found the advantages overbalanced and have removed their automatic feeders.

Watering

Many of the regular chore jobs will take more or less time, at the discretion of the operator. An adequate watering system may require almost no attention after it is installed. Examples are shown in Figs. 84 and 85. Assuming that water pressure is ample, the only attention such systems require is a glance while passing through to be sure water

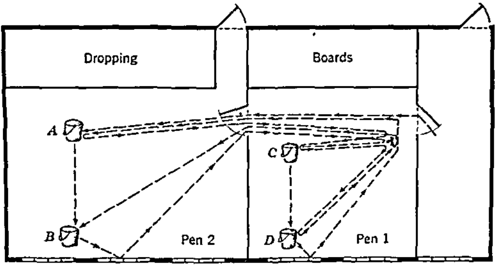

Fig. 88A. This poultryman traveled 22 miles a year, or 320 feet a day, to water 100 hens. The lines show the chore route this man followed in filling the water pails in each of two pens on one floor of a three-storied building. The route: Pick up pails *A* and *B*, empty them out of the window, leave them at the faucet, repeat with pails *C* and *D*. After this, individual pails are filled and replaced in the order *A*, *C*, *D*, *B*. You will notice that, although running water was piped to one end of the building, the man had to carry the water from the faucet just inside the door of pen 1 to all points in pens 1 and 2. The operator had a good reason for having the faucet arranged in this way. He thought it would be easier to drain the water pipes during the winter months to prevent freezing. To carry out this idea, he has a drain valve under the floor on the first floor, which permits the pipe to be drained quickly when necessary. (*Courtesy Professor L. M. Hurd, Cornell Univ.*)

is there or time for an occasional cleaning and rinsing. The opposite extreme is carrying warm water to the pens two or three times daily during cold weather.

Two methods of watering laying hens in use in New York State are illustrated in Figs. 88A and *B*. The pails in Fig. 88A are not protected against freezing although the main supply line is protected. The cone waterers in Fig. 88*B* are protected against freezing.

In a report from 85 poultry keepers in 28 Indiana counties taken in the winter of 1915, Wilhelm [4] shows the jobs done in one day required

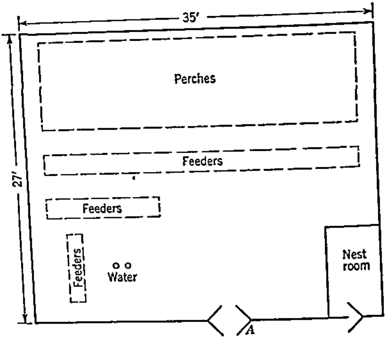

Fig. 88B. Two cone waterers supplied by water piped from an electric pump and with the pipe protected by electric heating cable service 320 hens. The operator looks through double-action hinged doors at *A*, to check the system. No chore labor is required. A stop and drain valve is located in a pit beneath waterers, if needed. The pit is connected by a drain to the outside. Morning chores consist of checking waterers and opening the entrance to the nest room.

less time in caring for hens and eggs on farms with:

1. Larger sized flocks.
2. Higher rate of production.
3. Flocks having both grain and mash stored in the laying house.
4. Farms that had water piped to the poultry house.

Watering is a time-consuming job. Larger flocks and water piped to the houses reduced the trips per 100 hens and the total time needed for watering the hens. The relation between labor efficiency and the system of watering on 78 Indiana farms for one winter day in 1945 shows the advantages measured in different ways.

	48 Farms Where Water Was Carried	*30 Farms Where Water Was Piped*
Number of hens	173	423
Percentage production	55	56
Trips per 100 hens	2.3	1.0
Minutes per trip	15 7	20.8
Minutes per 100 hens	35 2	21.7
Minutes per 100 eggs	64 3	39.0

Laying hens respond to a lack of water unfavorably and more quickly than to most other chore care. A water system should be automatic and protected against freezing. Bressler found that "installing automatic fountains in pens formerly serviced manually resulted in more reduction in time and distance than any other change on any farm." When protection against freezing was added labor was still further reduced. He has estimated the savings on several farms on the basis of 1000 hens and for a 10-year period (Table 96).

Table 96. Relation of Cost to Savings, Installing Automatic Watering Systems with Heating Cable,[2] 3 Pennsylvania Farms, 1948

Farm Number and Building	Net Cost	Minutes Saved Daily per 1000 Layers	Number of Days to Pay for the Change	Net Savings
Farm 8				
20′ x 40′ house	14.85	11.78	117	$450.95
Farm 9				
Entire house	146.30	26.93	502	918.56
Farm 10				
Single-storied house	281.32	34.93	745	1099.87
Remodeled barn	88.90	25.43	323	916 61

On one farm $281.32 paid for the installation which saved nearly 35 minutes daily. At $0.65 per hour, it would take 745 days to pay for the change, and in 10 years the saving in labor would be nearly $1100.

Feed Carrier

Bressler[2] found there are advantages to an overhead track and carrier beyond the actual saving in labor. Delivering feed to the feeders is made easier, as it eliminates carrying buckets of feed or bags of feed by hand. Its practicability depends on the length of house, and, since it is a "rather substantial investment," thought should be given before a cash outlay is made. "The cost of the equipment and installation plus charges for interest, repairs, and insurance for a 10-year period amounted to $160.54 in a house of 110 feet in length. The time saving benefits were only 3.61 minutes per 1000 layers daily. Over a 10-year period a loss of $17.79 would be incurred." Added length of house would likely prove more profitable, and a track and carrier would probably last much longer than 10 years.

Often the saving in human strength would justify the extra expenditure even though one may not justify the cost in dollars and cents. In

ing upon the method of watering, litter may need to be cleaned out around the waterers occasionally and dry litter raked in.

On many general farms poultry houses are cleaned frequently because of dampness or on general principles. Long straw in winter often gathers moisture quickly, as the particles are too long and bulky for rapid evaporation. The result is frequently a disappointment. Furthermore, the extra labor involved has an influence on the total labor for the year.

In central Indiana[7] the times litter was cleaned were tabulated with other factors on 100 farms for 1945–1946. Mortality is no different in these flocks, and size of flock may be partly responsible for the better production and financial returns. Extra cleaning does call for more man-hours per hen and appears to accomplish very little otherwise (Table 98).

Table 98

	Number of Times Cleaned per Year			
	More than 12	*6–12*	*2–4*	*1*
Greatest number of hens housed	188	216	199	237
Average number of hens per year	146	171	150	173
Mortality of hens housed (per cent)	10 *	11	12	12
Eggs per hen	149	157	151	176
Labor per hen (hours)	3.6	2 8	2.6	2.5
Labor returns per 100 hens (dollars)	37	68	100	116
Labor returns per hour (dollars)	0.11	0 26	0.52	0.64

* Excluding two cases with exceptionally large losses from epidemics.

The cost of frequent cleaning must be justified by lowered mortality, increased production, or better conditions for humans. Mortality may not be affected by dampness and unchanged litter so much as was once supposed. Better knowledge of ventilation and more modern watering equipment have reduced the need of removal for sanitary purposes.

Nutrients necessary to growing stock and breeding hens are synthesized in built-up litter. In addition, there are benefits in pen conditions through better moisture evaporation and floor insulation. Cleaning is desirable once or twice each year to remove solid, packed down portions, and thorough cleaning must be resorted to in the event infestation of worms, pullorum, fowl typhoid, fleas or mites, and the like, should get into the litter. Litter should be stirred occasionally when the surface starts caking over.

Given litter free of such problems, the need for complete removal of dry litter for hens seems not to exist

Kennard[8,9,10] and associates studied the effect of reuse of built-up litter on livability, growth, and production of chickens. Rations in-

complete in animal-protein ingredients plus built-up litter gave results nearly or quite equal to complete rations and new litter.

Brooding on old litter. Ammonia from built-up litter and brooding heat combined with inadequate ventilation is sometimes harmful and may cause blindness to chicks. Also, there is some thought (not yet proven) that the avian leukosis complex may be accentuated among chicks by the use of old litter during brooding. Because of our current lack of knowledge, and because we use as complete chick rations as are currently known, it may be best to continue with clean brooders, starting each lot on new litter, until more is known of these matters.

Number of Layers per Man

The number of birds per man is a measure of labor efficiency. Embleton [11] in 1941 indicated the "poultry farms in this area are working at less than half capacity so far as man labor is concerned." More birds per worker is accompanied by lower costs of producing eggs. A saving of one cent in the cost of producing a dozen eggs is equivalent to getting one more cent per dozen. The efficient poultryman strives for both (Table 99).

Table 99. Effect of Number of Birds per Man on the Cost of Producing Eggs, Arizona, 1941

	899 or Less	*900–1299*	*1300–1999*	*2000 or More*	*All Farms*
Average number of birds per man	596	1085	1560	2360	1434
Number of farms	9	13	10	12	44
Production per bird	149	143	127	140	138
Percentage mortality	26	33	24	19	25
Cost per dozen eggs	$0.334	$0.266	$0.284	$0.24	$0.254

Production man-work units (P.M.W.U.) * are shown in Table 112 for New York State, 1950, to be 0.2 for hens. On this basis of 2 hours of labor per hen per year, 1 P.M.W.U. or 10 man-hours are needed to care for 5 hens in 1 year. There are 365 days in the year and, if work averages 10 hours a day, then $365 \times 5 = 1825$ hens that should be cared for by one man. This means doing all the chores and preparing the eggs for market as well as the cleaning, culling, and other incidental work in caring for the flock.

However, pullets need to be raised. If two-thirds of the flock are raised each year, which would be 1200 pullets, and 0.05 P.M.W.U. are

* The amount of productive work, as measured by the number of 10-hour days required, under average conditions, to care for a hen during a year, to rear a pullet or to grow, harvest, and market a crop.

required to raise a pullet, this will take 60 ten-hour days. The man must either work longer than 10 hours daily or reduce the size of the flock.

It may become necessary to keep only 1500 hens on a 1-man plant, which will require 300 ten-hour days. One thousand pullets raised will take 50 ten-hour days or the equivalent of a total of 350 ten-hour days to care for the flock and raise replacements. Some poultrymen can do better than that, whereas many cannot reach that figure. Reference to Tables 109 and 110 show examples of flocks using 1 hour or less per hen per year.

It may be deduced, then, that it is possible to increase the number of layers per man by greater labor efficiency. When care is used in planning, the costs of production should be lowered and labor income or profits increased.

Scoville,[12] gives a practical illustration of the importance of labor efficiency shown in the accomplishment of labor on a successful New York State poultry farm. This farm is outstanding in rate of production, hens per man, dozens of eggs per man, and P.M.W.U. per man.

Average number of layers	2,025
Number of pullets raised	2,025
Man equivalent	1.4
Work units per man	393
Number of layers per man	1,446
Dozens of eggs per man	29,504

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16 · Capital

Investment:

Is a measure of size of business.
May easily get out of line and cause trouble.
Does not necessarily measure productive capacity.
Should equal 1½ years of receipts.
Is higher per hen in the Northeast than in the Pacific Coast area.
Generally is lowest per hen on high investment farms.
Generally is highest per hen on low investment farms.
Generally is highest on high-labor-income farms and lowest per hen.
Generally is lowest on low-labor-income farms and highest per hen.
Is something everybody has, if in the poultry business at all, regardless of size of enterprise.

The amount of capital invested is a less reliable measure of size of business than number of layers. A larger investment would be a reliable measure if it represented number of layers, necessary and efficient equipment, and the like; but it may be the result of too expensive housing, equipment, and land. Too low an investment may result in inadequate facilities, thus raising labor cost and losses.

One of the simplest and easiest pitfalls the poultry keeper is likely to fall into is that of overcapitalization. Capitalization well out of proportion to the number of birds carried will probably result in failure. If the plant is well stocked with birds but lacks the proper amount of equipment or buildings, the plant is undercapitalized and handicapped. The same is true if the equipment and buildings are ample but too little stock is carried. Capitalization of a poultry plant does not necessarily measure productive capacity.

It is not possible to say how much should be invested on an individual-hen basis. Costs for farms, stock, and equipment vary so greatly in various parts of the country and in different years due to the rise and fall in the purchasing value of the dollar that no exact or constant investment per hen or per farm can be given.

Reasonable capitalization is important, and thought and planning should be stressed when so-called permanent investments are to be made. Sensible but not elaborate houses and equipment, production-bred chicks (disease-free rather than cheap), and a business large enough

and equipped well enough to provide efficiently used labor are needed.

Investment means the amount of capital represented in land, buildings, poultry, equipment, feed on hand, and anything else used to conduct the enterprise. To determine the amount of the investment one should fill in for his enterprise the poultry inventory found in poultry account books, adding any items not listed there. To find the average investment for a year, average the two inventories, one at the beginning and one at the end of the year.*

Receipts vs. Capital

A measure of capital efficiency is the number of years that it takes for receipts to equal the money invested in the poultry farm. Too high an investment or a poorly conducted business may require several years. In general, "not more than 1½ years should be required." [1]

There appears to be a relation between the number of years necessary for receipts to equal capital and the labor income. Records for 1073 poultry farms in New York State from 1926 to 1941 were divided according to the years required for receipts to equal capital; low (about 1.5 years), medium (about 2.4 years), and high (about 4 years). The labor income averaged, respectively, $2310, $1140, and $190.[1]

On a poultry farm or ranch there are many forces at work. Some are favorable to the poultryman; others are not. We have seen that returns should equal capital in a few years, but often it takes several years. Winner [2] found that the rate of production is an important factor, and, since the number of eggs per bird is likely to affect the returns, low-producing flocks are expected to require more years to equal the capital. Table 100 shows, for 1581 records from 1934 to 1945, that egg income

Table 100

Eggs per Layer [a]	*Percentage of Income* *Eggs*	*Fowl*	*Years to Repay Capital Investment* [b]
100 or below	73	27	7.7
101–125	77	23	5.3
126–150	79	21	3 1
151–175	82	18	2 2
176–200	81	19	1.6
Over 200	87	13	1 6

[a] There was no relation between various breeds and these factors.

[b] Capital investment includes poultry laying and brooder houses, stock, and miscellaneous equipment.

* Details concerning inventories and other accounts will be found in Rice and Botsford, *Practical Poultry Management*, John Wiley & Sons, New York, 1949

increased and meat income decreased with higher production and that the years to repay the capital were influenced.

A comparison of both wholesale and retail egg-producing farms, and breeding farms including baby chick and hatching-egg businesses, was made in a survey of 114 commercial poultry farms in 7 eastern counties of Massachusetts for the year 1937.[3] The relation of investment, receipts, and labor income is shown in Table 101. The business of these

Table 101

Factors	*All Farms*	*Wholesale*	*Retail*	*Breeding*
Number of farms	114	71	34	9
Capital invested	$12,042	$11,631	$9,791	$23,788
Receipts—poultry business	$8,999	$8,411	$7,443	$19,510
Years for receipts to equal capital	1.34	1.38	1 32	1.22
Labor income	$1,091	$1,130	$681	$2,336
Average number of layers	1,180	1,207	942	1,860
Investment per layer	$10.21	$9.64	$10.39	$12.80

farms appears to be well related to investment. From 1¼ to 1⅓ years are required for receipts to equal investment. The amount of capital per bird is high on these New England farms compared with those of the milder climates of the West Coast and the Pacific Islands.

Los Angeles, California, poultrymen are favored with conditions conducive to a low investment per hen. The five most profitable flocks had $2.52 less investment per hen; produced 48 more eggs per hen; had 31.7 per cent more pullets; had lower feed cost; used 12 per cent less mash; paid more per hour for hired labor; used 1.3 fewer man-hours per hen, including operator and family help at a saving of $0.91 per hen; and produced eggs for $0.21 less per dozen than the 5 least profitable flocks. The 13 high-average farms were more efficient in several ways than the 13 low-average farms[4] (Table 102).

Table 102

	Number of Flocks	*Investment per Hen*	*Management Income per Hen*
Most profitable flocks	5	$5.00	$2.39
Least profitable flocks	5	7.52	−0.62
Average of all records	15	5.45	1.24
13-year high average	107	3 57	1.36
13-year low average	108	4.90	−0.16

Similar advantages are found on 46 poultry farms in British Columbia[5] where the total investment per bird is low and related to the labor income per bird and per dozen eggs (Table 103).

Table 103

	Average of All Records Summarized	*High-Income Flocks*	*Low-Income Flocks*
Land	\$0.92	\$0.70	\$1.34
Buildings	2.05	1.46	2.55
Equipment	0.28	0.16	0.19
Birds	1.70	1.61	1.51
Total	\$4.95	\$3.93	\$5.59
Labor income	\$1.52	\$2.53	\$0.57
Labor income per dozen eggs	0.105	0.157	0.043

Climatic conditions in the West, availability of building materials, and the like are slightly more advantageous than in the East. The easterner is meeting the problem of cost by constructing large laying and brooder houses for large flocks of layers or chicks, thereby reducing the building cost per bird to \$2.50–\$3.00.

Table 104

Average	*Investment per Farm*	*Investment per Hen*	*Labor Income per Farm*	*Number of Hens per Farm*
		1918–1919		
11 farms	\$1300	\$ 6.17	\$ 688	211
5 high	1973	6.01	1077	328
5 low	678	6.78	275	100
		1919–1920		
17 farms	\$2832	\$ 8.10	\$1366	350
5 high	5055	7.28	2714	694
5 low	1101	9.33	279	318
		1920–1921		
23 farms	\$3860	\$ 8.00	\$1425	483
5 high	6985	8.20	3709	852
5 low	2328	11.20	−119	208
		1921–1922		
10 farms	\$3059	\$ 7.13	\$1167	412
5 high	3712	6.00	2174	619
5 low	2656	7.68	415	346
		1922–1923		
28 farms	\$3527	\$ 8.39	\$ 972	420
5 high	7744	7.90	2593	981
5 low	3055	11.70	20	208

The relation between investment per hen and labor income per farm and per hen is apparently deeply rooted and not something that just happens. The Department of Poultry Husbandry at Cornell from 1918–1919 to 1929–1930 collected and summarized records kept by poultrymen about the state in the then known poultry-management project. Figures for 5 of these years are given in Table 104. The average of all farms each year and the 5 highest and 5 lowest labor-income farms are shown.

In each case the 5 high-labor-income farms had the lowest investment per hen, the highest total investment, and the largest flock.*

Distribution of the Capital Invested in an Egg-Production Enterprise

Land and buildings comprise a high percentage of the total investment according to the figures available from several sources.

Locality and climate appear to be influencing factors. In Hawaii, where housing costs are relatively low, the major part of the total investment was in poultry stock in 1948.

In 1947, California had nearly as much capital represented in poultry stock, equipment, feed, and supplies as in land and buildings.

The percentage in land and buildings ranged from 57 to 66 in British Columbia, Illinois, New Hampshire, and New York (Table 105).

Table 105. Distribution of the Capital Invested, Percentage of Total Investment per Bird

	British Columbia 1944–1945	*Hawaii 1948*	*California 1947*	*New Hampshire 1942–1948*	*Illinois* [a] *1932–1937*	*New York 1940–1941*
Land	18.6	13.0	6.3	—	—	—
Real estate	—	—	—	57.0	64.8	66.0
Buildings	41.4	22.0	44.0	—	—	—
Poultry stock	34.3	46.0	31.1	—	27.4	12.0
Livestock not poultry	—	—	—	28.2	—	6.0
Equipment	5.7	13.0	9.7	10.2	—	4.0
Miscellaneous supplies	—	6.0	—	4.6	—	8.0
Equipment and supplies	—	—	—	—	5.8	—
Feed and supplies	—	—	8.9	—	—	4.0
Feeds	—	—	—	—	1.7	—
Straw and bedding	—	—	—	—	0.3	—
	100.0	100.0	100.0	100.0	100.0	100.0

[a] Six-year average of semi-commercial flocks.

Items included under capital invested varies In New York, 1940–1941, the survey figures on 120 farms covered the entire farm of which poultry was the major enterprise. Hence, 6 per cent of the investment

* Unpublished data, H E Botsford, Cornell University

was in livestock other than poultry. Illinois records, 1932–1937, showed a small amount for straw and bedding.

A careful recording of all items used for or by poultry and including the poultry is needed to arrive at a true picture of the investment required on a particular farm for doing the job.

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17 · Summary of Poultry-Farm Business Factors

We have seen the relation to labor income, profits, and costs of size of business, rate of production, mortality, labor efficiency, capital, and receipts. Farms which are high in one or more of these factors are likely to fall into higher labor income and profit groups according to the number of factors in which they excel.

Relation of Number of Business Factors to Labor Income and Profit

From time to time students of poultry-farm management have grouped poultry flocks according to the number of efficiency factors in which each flock excels. The factors used are those which have been found related to returns. The object has been to see the cumulative effect of several factors.

Jones used six factors in 1938 which had shown favorable relationships to labor income. A definite trend toward higher labor incomes per farm resulted as the number of factors in which a group excelled increased. See Table 106. The six factors used were:

1. High egg production per hen.
2. High egg production during October and November.
3. Low mortality.
4. High sales relative to fixed costs.
5. Efficient labor.
6. Volume and diversity of industry

Table 106. Relation of Labor Income to the Number of Factors in Which a Group of Poultry Farms Is Above Average, 105 Connecticut Poultry Farms, 1937 [1]

Number of Factors in Which the Farm Excels	*Number of Farms*	*Net Cash Earnings*	*Labor Income*
None	9	$ 48	$−216
1	11	43	−182
2	21	536	459
3	29	742	503
4	17	896	605
5	11	904	1314
6	7	3041	2717

Three factors were used in a study by Darrah on 120 New York poultry farms, 1940–1941, representing size, rate of production, and labor efficiency. A definite trend was shown. Work units were used, since the survey covered the entire operation on the farm. When all farms were placed in their proper grade, grouped and averaged for each grade, the trend was pronounced. See Table 107. The three factors were:

1. Work units
2. Eggs per layer.
3. Work units per man.

Table 107. Relation of Number of Average or Better Factors to Labor Income, 120 New York State Poultry Farms, 1940–1941 [3]

Number of Factors Average or Better	*Number of Farms*	*Work Units*	*Eggs per Layer*	*Work Units per Man*	*Labor Income*
None	17	292	144	158	$ −15
1	48	391	176	209	1263
2	41	805	161	288	2313
3	14	1042	191	347	2552
Total or Average	120	594	168	257	1601

Darrah used six factors in grouping 1073 poultry-farm records (Table 108) taken from 1926 to 1941. The factors, and the grading of the farms according to the number of factors in which each farm varied from the average were:

Factors	*Grade*	*Relation to the Average*
1. Size of laying flock.	Very poor	Below in all factors
2. Eggs laid per layer.	Poor	Above in one factor
3. Eggs produced per man.	Fair	Above in two factors
4. Deaths.	Fairly good	Above in three factors
5. Eggs laid in the fall months.	Good	Above in four factors
6. Use of capital.	Very good	Above in five factors
	Excellent	Above in six factors

Table 108. Grade of Poultry Farms and Labor Income of Each Group, 1073 New York State Poultry-Farm Records, 1926–1941 [3]

Grade	*Labor Income*
Very poor	$ −180
Poor	330
Fair	730
Fairly good	1240
Good	1810
Very good	2380
Excellent	3180

Comparing Individual Farms with Averages of Groups of Farms Having Records for the Same Year

In Table 109, for a single farm, the important factors are listed for comparison with farms in the same survey or with poultry farms keep-

Table 109. Comparison of One Poultry Farm with Others in the Same Year; Factors from the New York Poultry-Farm Management Survey, 1946–1947, 172 New York State Farms*

LAYING FLOCKS

	All Farms	*Heavy Breeds*	*Light Breeds*	*Single Farm*
Number of farms	172	53	82	1
Size of enterprise				
Average number of layers	917	614	1,095	960
Dozens of eggs produced	13,173	9166	15,985	15,030 [a]
Rates of production				
Eggs produced per layer				
Fall	42	44	42	49 [a]
Summer	46	47	48	36 [b]
Year	172	179	175	188 [a]
Deaths, percentage mortality of layers	15.7	16.3	15.2	22 [b]
Labor efficiency; man-hours per layer	2.1	2.3	2 0	1.0 [a]
Costs and returns				
Feed cost per layer	$4.57	$4.76	$4 52	$4 25 [a]
Total cost to keep a layer	$7.62	$7.68	$7.64	$6 79 [a]
Cost per dozen eggs	$0.530	$0 514	$0.524	$0 43 [a]
Value per dozen eggs	$0.541	$0.512	$0 549	$0 54 [b]
Return per man-hour	$1 52	$1 49	$1 69	$2 39 [a]
Other factors				
Pounds of mash per layer	56.9	62 6	54.9	32
Total pounds of feed per layer	110 6	116 8	108 6	115
Pounds of feed per dozen eggs	7 3	7 5	7 2	7 [a]

REARING FLOCKS

		Sexed Pullets		*Straight-*	
	All Farms	*Heavy Breeds*	*Light Breeds*	*Run Heavy Breeds*	*Single Farm*
Number of pullets raised	1279	1055	792	428	951
Percentage mortality	14	10	13	23	9
Pounds of feed per pullet	32	34	25	50	22
Minutes of labor per pullet	33	33	32	50	11
Net cost per pullet	$2 28	$2 49	$2 27	$2.27	$1.92 [a]

* L. B. Darrah and C D Kearl, unpublished data 1950

[a] Strong points on the single farm

[b] Weak points on the single farm

ing cost accounts in the same year Weaknesses or strong points may be quickly seen when compared with group averages. On this farm the disease avian leukosis complex gave high mortality. Egg production was not seriously impaired among the survivors. Chicks were hatched in February and April. More February or earlier hatched chicks should increase production during the first summer and not decrease fall production.

The price appears to be a weakness, averaging nearly $0.01 less per dozen than the average of all light-breed farms, of which this farm is one. A decrease of $0.009 on about 15 thousand dozen eggs is thought provoking. It is a loss of $135 in this case. To be sure, the cost per dozen is much lower, but the two means of increasing net returns are: (1) lowering the cost per dozen eggs; and (2) increasing the price per dozen. This farm is below average in (2). Reasons for this price difference may be:

Low summer production.
Ratio of hens to pullets.
Price for hatching eggs on certain other farms.
The place where eggs are marketed.

Comparing Individual Farms by Means of Medians

For any particular factors the medians are found for an entire group of farms or for the farms grouped in thirds or other divisions. In Table 110 the various factors for each of the 22 records for 1949 were found

Table 110. Poultry Farm Business Factors from 22 Hen Cost Accounts, 1949, Arranged by Thirds for Each Factor, with Medians Determined*

	Low Third	*Middle Third*	*High Third*	*Low-Profit Flock*	*High-Profit Flock*
Size of flock	321	1078	2127	1283	5,255
Eggs per hen	149	186	216	105	216
Total cost per hen	*$6.02*	*$7.25*	*$8.63*	*$5.78*	*$6.48*
Total returns per hen	$5.79	$7.60	$9.19	$4.50	$9.39
Cost per dozen eggs	$0.39	$0.48	$0.60	$0.66	$0.36
Value per dozen eggs	*$0.40*	*$0.51*	*$0.55*	*$0.51*	*$0.52*
Man-hours per hen	1.00	1.40	1.80	1.40	0.70
Returns per man-hour	$0.05	$1.48	$2.22	$-0.27	$4.77
Mortality, *per cent*	14	22	31	20	20
Profit	$-352.00	$401.00	$3399.00	$-1613.00	$15,305.00

* Adapted from *A.E. 756*, Farm Cost Accounts, *Dept. of Agr. Econ., Cornell Univ.*, December 1950. All accounts were separated into thirds, high to low, for each factor, and the median was found for each third. Factors are independent of each other.

and tabulated by farms. Similar factors were then in columns. The figures under each factor were divided into high, medium, and low groups, and the median was found for each group.

Each group of thirds may show both favorable and unfavorable results. It may be desirable for a farm business for example to be low in cost per dozen eggs, man-hours per hen, or mortality, but undesirable to be low in size of flock, eggs per hen, or profit.

It is good, therefore, to be in the low group for certain factors and in the high group for others.

The high-profit flock was high in the important business factors of size, production, returns per hen, returns per man-hour, and profit; and was low in cost per dozen eggs and labor per hen; but was comparable with the middle group in value per dozen eggs and mortality.

The low-profit flock had an average-sized business; and, although the value of eggs sold was fair, there were too few eggs to sell, and, hence, returns were below costs, resulting in a minus return per man-hour and profit.

Comparing Individual Farms by Means of a Decile or Poultry-Farm Business Chart

A chart may be prepared from survey records or account farms. A large number of records is desirable. By its use a poultryman may determine whether his business is above or below the average of his fellow poultrymen for that year.

Constructing the chart. The farm records are arranged in order for each factor, and each factor is divided into 10 equal groups. In Table 111 the averages for each group of 10 were arranged as shown, and a median for each group placed across the center. The figures in the top row across are the averages for the 10 highest farms in each particular factor. The columns are independent of each other.

For the individual farm to be studied, mark the approximate location of each factor on the chart and draw lines across the different columns

*Table 111. Variation in Important Farm Business Factors, 172 Poultry Farms, New York, 1947 **

Size of Flock	*Rate of Production: Eggs per Layer Year*	*Rate of Production: Fall October–November*	*Percentage Mortality*	*Labor Efficiency; Man-Hours per Layer*	*Profit on Enterprise*
2781	224	53	4	1.0	$ 3784
1369	208	34	8	1.5	1447
1136	197	30	10	1.6	857
941	187	27	12	1.8	415
807	179	25	14	2.0	82
721	176	24	15	2.2	−99
635	173	23	16	2.3	−116
500	165	22	18	2.6	−310
419	154	20	20	3.1	−592
320	131	16	24	3.7	−1056
193	110	10	39	5.1	−2530

* Courtesy of C. D. Kearl, who tabulated the deciles for the author from his survey figures.

connecting them, or block in the point where the farm to be compared falls. The strong and weak points of a farm in relation to the experiences of others can be quickly observed.

In the example charted on Table 111, the factors on the poultry farm being compared are:

Size of flock	1705
Eggs per layer	212
Mortality	14%
Man-hours per hen	1.03
Profit on enterprise	$2376

Poultry-Farm Records and Accounts

Almost all persons engaged in practical poultry work keep certain poultry records, such as brooder, egg, flock, cash expenses or receipts, and the like. The market-egg producer may be interested only in cash records which are usable in filling out the income-tax sheet, such as records of cash sales, cash expenses, estimates of depreciation on property, cash income from any other transactions not otherwise included, and receipts of anything of value instead of cash for farm products sold. If on the accrual basis, an inventory is required at the beginning and end of the year of any livestock, crops, or other products on hand, together with the amounts of them purchased and sold during the year and with the record of operating expenses and of depreciation.

Should the business include buying and selling, borrowing money, paying loans, giving credit, and the like, such as a hatchery business, private consumer or store trade for eggs or poultry, separate and special accounts are needed. When the business can support a trained accountant, a complete set of double-entry accounts will show upon summarizing the gain or loss on each separate phase of the business.

A simple form of a poultry cash record results when all cash outgo and cash income is kept in a check book separate from other personal business. It would not show interest charges, unpaid labor, or home use of poultry and eggs. The difference between the deposits and the expenditures shows the cash balance at any time.

The main purpose of a poultry account is to be able to study the enterprise and find how it can be made more profitable. Not only should the poultryman be able to determine his profit or loss, but also he should be able to find where his strong or weak points are by comparison with other records and by checking against facts and figures such as those presented elsewhere in this book.*

* A more complete description and an example of recording and summarizing a poultry account will be found in *Practical Poultry Management*, by Rice and Botsford, John Wiley & Sons, New York, 1919.

By keeping appropriate daily records the poultryman should, at the end of the year, obtain the following important information concerning his poultry enterprise:

1. Profit or loss.
2. Return per man-hour.
3. Total costs, classified by types of cost.
4. Total receipts, classified by types of receipts.
5. Production, cost, investment, pounds of feed consumed, and profit or loss per bird.
6. Average cost of production and price received for eggs.
7. Average cost of raising pullets.
8. Mortality.

The records needed to find the factors mentioned above, as well as others which should suggest themselves are:

1. Inventory.
2. Labor record
3. Expenses
4. Receipts
5. Expense and receipt summary
6. Financial summary
7. Egg production, mortality, and culling record
   (Supplement: laying-house card)
8. Brooding and rearing record
   (Supplement: brooding and rearing mortality card)
9. Poultry-business factors

Many state agricultural colleges provide poultry account books at a nominal charge.

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3. Darrah, L. B., Make Your Poultry Farm Pay, *Cornell Univ. Ext. Bull.* 713, April 1947.

18 · Reorganizing a Farm for Poultry

Much of the poultry in the United States is kept on general farms. Often a farm may or may not be operating efficiently in all departments. In certain cases, crops should be reduced or added to, or one or more kinds of livestock eliminated except where it serves the needs of the family in supplying meat, milk, eggs, or other commodities. To bring about an improved relationship among the farm enterprises and a better balance between the needs of the family in farm-grown commodities and available cash, reorganization may prove desirable. It is well to compare important factors on the farm in question with some standard. The following example illustrates a method of studying the business.

The measures used are:

- Animal units.
- Man equivalent.
- Production man-work units (P.M.W.U.).
- Crop index weighted by acres.
- Crop index weighted by P.M.W.U.

The efficiency of the farm in its present state is determined, the strong and weak points are found, and suggestions made on the basis of the findings for better labor efficiency and returns.

Animal Units

From *15 to 20 animal units per man* is considered a good working relation.

To find the animal units, multiply the number of animals on the farm by the appropriate figure below, and add the products.

An animal unit is the equivalent among stock on the basis of feed consumption and manure produced. Figures in common use are.

1.0, cows	0.2, brood sows and boars
0.5, heifers	0.1, hogs raised
0.5, calves	1.0, mature poultry, per 100
1.0, horses	3.0, pullets raised, per 1000
0.14, ewes and bucks	

Table 112. Work Units for Livestock and Crops *

	Number or Amount on This Farm		Work Units per Head		Total Work Units
Livestock					
Cows	______	×	14	=	______
Heifers	______	×	2	=	______
Bulls	______	×	5	=	______
Hens	______	×	0.2	=	______
Pullets raised	______	×	0.05	=	______
Broilers raised	______	×	0.02	=	______
Brood sows	______	×	3	=	______
Hogs raised	______	×	1	=	______
Ewes and rams	______	×	0.5	=	______
______	______	×	______	=	______
______	______	×	______	=	______
			Work Units per Acre		
Crops					
Hay	______	×	1	=	______
2nd and 3rd cuttings	______	×	1 †	=	
Corn silage	______	×	3	=	______
Corn for grain	______	×	1.5	=	______
Oats	______	×	1.2	=	______
Barley	______	×	1.2	=	______
Oats and barley	______	×	1.2	=	______
Wheat	______	×	1.2	=	______
Buckwheat	______	×	1.2	=	______
Dry beans	______	×	3	=	______
Potatoes	______	×	7	=	______
Cabbage	______	×	9	=	______
Peas for canning	______	×	2	=	______
Sweet corn for canning	______	×	4	=	______
Tomatoes for canning	______	×	14	=	______
Apples, commercial	______	×	12	=	______
Home orchard	______	×	3	=	______
Fruit not of bearing age	______	×	2	=	______
______	______	×	______	=	______
______	______	×	______	=	______
Miscellaneous					
Work off farm, per day	______	×	1	=	______
______	______	×	______	=	______
______	______	×	______	=	______
			Total work units		

* Courtesy of Dr Stanley Warren, Department of Agricultural Economics, Cornell University.

† One work unit per acre for each cutting.

Man Equivalent

Translate the labor provided by each man into approximate full-time months of man-labor, total, and divide by 12.

MAN EQUIVALENT

Workers	*Full-Time Months*
Operator	
Hired men	
Sons	
Other	
Total	
Man equivalent (Total ÷ 12)	

Production Man-Work Units

These are listed in Table 112 for the more common types of livestock and crops in New York State, 1950. It will take about 2 man-hours each year to care for 1 hen, or 10 hours to raise 1 hog. The number of stock or acres of crops × The work units shown = The approximate work units required to do the work on the farm; *270–300 P.M.W.U. per man* is considered above average.

Crop Index

This is a measure that tells how much the yields on the particular farm are above or below the average for a section or a state or a group.

The data necessary are:

Yields on the farm per acre, each crop.
Average yields in the community, county, or state for each crop concerned.
Total P.M.W.U. for each crop.

The crop index may be weighted by acres or by P.M.W.U. The result should help determine, when the farm is reorganized, whether a shift in crops had best be made.

To Find the Crop Index Weighted by Acres

The total yield of each crop divided by the average yields for that crop per acre gives the acres required at average yields. Total, divide by the acres used on the farm under consideration, and multiply by 100. This gives the crop index weighted by acres.

To Find the Crop Index Weighted by Production Man-Work Units

Find the number of acres at average yields for each crop and multiply by the P.M.W.U. per acre. This gives the P.M.W.U. at average yields.

Total, divide by the P.M.W.U. on the farm being considered, and multiply by 100. This gives the crop index weighted by P.M.W.U.

Steps in Reorganizing a Small General Farm

1. Find the original acreage and use.
2. List the animals and numbers of each.
3. List the crops, acreage, and yields (total and per acre).
4. Determine the animal units.
5. Determine the P.M.W.U. for animals.
6. Determine the P.M.W.U. for crops.
7. Find the crop index.*
8. Find the man equivalent and P.M.W.U. per man.

EXAMPLE OF REORGANIZING A SMALL GENERAL FARM IN NEW YORK STATE

This is a small, diversified livestock and crop farm with a large barn and comfortable dwelling. The sources of income are beans, lambs and wool, and stock sales of cows and poultry. Crops raised are oats, wheat, fodder corn, and hay for feed.

Strong points: better than average yield of beans.
Questionable points: small, diversified business.

The Problem and Analysis of the Original Farm

1.† *Acreage and Use*

Homestead	1.5
Tillable	29.7
Tillable pasture	4.3
Untillable pasture	46.3
Pasture not used	2.8
Woodlot	1.8
Idle	6.3
Total	92.7

2, 4, 5.† *Number of Animals, Animal Units, and P.M.W.U. for Animals*

Average Number of Animals	*Animal Units*	*P.M.W.U.*
2½ cows	2.5	35.0
2 horses	2.0	—
210 hens	2.1	42.0
50 sheep	7.0	25.0
280 pullets raised	0.8	14.0
1½ pigs	0.3	1.5
Total	14.7	117.5 P.M.W.U. for animals

* Average yield should be those of the community, county, or state in which the farm is located.

† Numbers refer to steps listed above.

3, 6.† *Crops, Acreage, Yields, and P.M.W.U.*

Crops	*Total Yield*	*Yield Per Acre*	*P.M.W.U.*
2½ a. beans	52 bu.	20.8 bu.	7.5
7 a. oats	222 bu.	31.7 bu.	8.4
6 a. wheat	136 bu.	22.6 bu.	7.2
2 a. corn fodder	—	—	6.0
14 a. hay	17 tons	1.2 tons	14.0
29½ a. excluding corn fodder			43.1 P.M.W.U. for crops

7.† *Crop Index Weighted by Crop Acres**

	Total Yield		*Average Yield per Acre*		*Acres Required at Average Yields*
Beans (dry)	52 bu.	÷	16 bu.	=	3.25
Oats	222 bu.	÷	32 bu.	=	6.94
Wheat	136 bu.	÷	25 bu.	=	5.44
Hay	17 tons	÷	1.5 tons	=	11.33
			Total acres		26.96

26.96 ÷ 29.5 (acres cropped on this farm) = 0.914 × 100
= 91.4 (crop index weighted by acres)

*Crop Index Weighted by P.M.W.U.**

	Acres at Average Yields		*P.M.W.U. per Acre*		*P.M.W.U. Required at Average Yields*
Beans	3.25	×	3.0	=	9.75
Oats	6.94	×	1.2	=	8.33
Wheat	5.44	×	1.2	=	6.53
Hay	11.33	×	1.0	=	11.33
Total	26.96				35.94

35.9 ÷ 37.1 (P.M.W.U. on this farm for the four crops) = 0.967 × 100
= 96.7 (crop index weighted by P.M.W.U.)

8.† *Totals for the Farm*

Animal units	14.7	
Man equivalent	1.08	(*1 man full time and about 1 month extra help*)
P.M.W.U. per man	148.7	((117.5 + 43.1) ÷ 1.08)
Crop index weighted by acres	91.4	(8.6% below average)
Crop index weighted by P.M.W.U.	96.7	(3.3% below average)

* The crop yields are those for *New York State, 1937–1946 averages from U.S.D.A Agr. Statistics*, 1949.

† Numbers refer to steps listed on page 236.

Reorganizing the Farm

Cows do not fit into this size farm because of small crop acreage. Assuming additional land cannot be rented in order to increase the dairy herd to a profitable unit,

1 cow may be kept for home use, selling and buying as needed, probably about each 5 years, or raising a heifer occasionally to replace the cow. Two acres of tillable pasture for the cow and occasional heifer may be required.

Sheep may do better than cows on the hilly pasture. Retaining them should give an income for that acreage allowing about 1 sheep to an acre and using the untillable pasture and pasture not originally used.

Keep the *pigs* needed for home use only.

One *horse* should do the cultivating and other necessary light work, although a small tractor might profitably replace the horse and do much of the plowing and fitting. However, the field work may be hired, as was originally done, or the crop land may be rented out entirely or on a share basis if the horse is kept. Mow space for 3 tons of hay is needed for the cow and another 3 tons if the horse is kept; 600 cubic feet of mow space will hold 1 ton of unsettled hay.

Poultry appears to be a logical main livestock enterprise because the barn is available. Range can be set aside or the pullets confinement-reared. The barn can be remodeled to house a considerable number of birds. Later it may be added to if it appears desirable to build the flock to 2500 or 3000 layers. The aim might be to use the remodeled barn for poultry, grain, 1 cow, and hay and storage space.

Twelve hundred hens can be accommodated. Nine hundred pullets may be reared each year, and 300 of the best hens held over. One hundred per cent renewal can be practiced, if desired. Four acres will be needed for range using 2 acres annually, with an alternate range of 2 acres. The extra 2 acres each year will be available for crops. Wheat or corn may be grown on the 4 acres. If a permanent pasture is preferred, the 4 acres can be cropped in ladino clover and any excess harvested, sold, or used. Should predators be bothersome, confinement rearing may be followed.

This leaves 29.7 acres of tillable land and 2.3 acres of tillable pasture, or 32 acres that can be cropped. As the original crops do fairly well on this farm, a rotation including hay, beans, and oats may be installed. The range for poultry may be used as previously suggested.

Excluding 4 acres for poultry, 28 acres are available. A rotation of hay 2 years, beans 1 year, and oats and seeding 1 year may be installed, resulting in 14 acres of hay, 7 acres of beans and 7 acres of oats annually.

Sufficient manure will be produced for the 14 acres of beans and oats, using 5 tons per acre of cow and sheep manure, supplementing with poultry manure to give any required tonnage. Extra poultry manure may be sold, exchanged for team or tractor hire, used on corn land, or otherwise disposed of.

Changes are suggested as follows.

Stock and Crops	*P.M.W.U.*	*Animal Units*
1 cow	14.0	1.0
50 sheep	25.0	7.0
960 hens (average)	192.0	9.6
900 pullets raised	45.0	2.7
14 a. hay	14.0	
7 a. beans	21.0	
7 a oats	8.4	
4 a corn or wheat	6.0	
Total	325.4	20.3

This will require the operator's full time, with extra help at harvest time, assuming the crop land is not rented out.

Tentative Results with Poultry (Using Conservative Estimates)

Layers at start of laying year	1200
Pullets	900
Yearlings	300
Mortality of adults @ 20%	240
Sales, 2-year-old hens	180
Sales, yearlings	420

Income

13,948 doz. eggs @ $0.50 (annual average)	$6974
660 hens @ $0.65	429
50 sheep	350
7 a. beans	?
7 a. hay (yield from 7 a. used)	?
7 a. oats	?
4 a. corn	?

Changes Suggested

	Old	*New*
Animal units	14.7	20.3
P.M.W.U. (total)	160.6	325.4
Man equivalent	1.08	1.2
P.M.W.U. per man	148.7	271.1
Hens	210.0	1200.0
Pullets raised	280.0	900.0

Business Analysis

Size	
P.M.W.U.	325.0
Acres of crops	32.0
Acres pastured	46.0
Animal units	20.0
Number of hens	1,200 0
Man equivalent	1.2
Production	
Eggs per hen	175 0
Crop index (based on New York yields)	
a. Weighted by acres	91.0
b. Weighted by P.M.W.U.	97.0
Labor Efficiency	
P.M.W.U.	271.1
Animal units per man	17.0
Dozens of eggs per man	11,667.0
Hens per man	1,000.0

Buying a Poultry Farm

A unique method of buying a dairy farm is advanced by a Vermont publication.[1] Debts and interest charges are not changed by fluctuations of price level or other factors causing farm prices to change. Consideration beforehand by both seller and buyer may avoid misunder-

standings and loss later. The price will be decided when the sale is made. A contract is made to buy in terms of the value of a certain number of dozens of eggs or pounds of milk annually over a specified number of years.

Should the annual price of a dozen of eggs be higher in any year than that which prevailed when the purchase price of the plant was reached, the seller would get more total dollars for that payment year. If the price is lower, the seller gets fewer dollars. Thus, both buyer and seller are interested in the general price level and both are better protected against disastrous losses.

Adapting the idea to purchasing a poultry farm, we will assume the farm value is $15,000, of which $5000 is paid in cash.

$15,000	Purchase price
5,000	Cash payment at time of purchase
10,000	Balance to be paid over a 20-year period
3,800	Interest @ 4% on unpaid balance, with annual payment on mortgage of $500
660	Annual payment for 20 years
0.571	Annual New York farm price for eggs, 1949
1,155.9	Dozen eggs required to pay mortgage and interest annually

Seventy-seven hens producing 180 eggs, or 15 dozen per hen, will give the required dozens. Since the poultryman has costs to meet in getting the necessary production, he should determine the possible profit per bird and meet the payments from the profits.

$0.571	Average annual New York farm price, 1949
0.454	Probable cost per dozen
0.117	Profit per dozen
1.75	Profit per bird @ 15 dozen
395	Birds required to meet payments at this cost and return after all costs are paid

Should the price per dozen drop, the seller will receive fewer total dollars from the sale of 1155.9 dozen eggs annually. If the price per dozen advances, the seller will receive more dollars. Thus, the buyer is able to meet the annual payment in terms of dozens of eggs rather than in actual dollars and cents.

A method of this sort applies best when buyer and seller have a mutual interest in the farm and in each other. Both are desirous of having security from a fluctuating price level. A father has reached the age when he wishes to retire from the active part of the business, and the son is ready to take over the ownership and management. The father, although a farm owner, may have been fearful of deflation and possible

inability to pay fixed charges such as mortgages, taxes, and insurance. After selling his farm, he may fear inflation, because a fixed number of dollars during inflation may buy less than formerly. The father, after selling, is a pensioner desirous of meeting easily any fluctuating price changes. He wants a steady income the rest of his life.

The buyer, the son, is the one who now fears deflation and looks forward to inflation.

Under the new arrangement the father will have more income when inflation comes and prices are high. In depression times he will need less and will have less. He is secured.

The son is interested in producing the amount of eggs agreed upon. Their sale price meets his obligation to the father in eggs and not in fixed dollars. He is secured.

Both can start with the current farm price and the proper understanding. Strangers had best complete their transactions on a dollar basis. Banks could not function in this manner, as their business is on a straight dollar basis regardless of the value of the dollar.

REFERENCE

1. Beck, R. S., and S. W. Williams, Guides to Successful Farms in Vermont, *Univ. of Vt.* and *Vt. Agr. Coll. Dept. of Agr. Econ.*

19 · The Broiler Industry

Broiler growing has increased tremendously in the United States in the last 16 years. The index of the gross broiler income increased, 1934–1949, from 48 to 1064 and the purchasing power from 52 to 551.

Total consumption of broilers is increasing. Per capita consumption in 1949 increased 39.2 per cent in the 15 years since 1935 but was only 3.7 pounds more than in 1930.

Sixty-four per cent of all the broilers in the United States are produced in the North Atlantic and South Atlantic states.

Production of broilers by states in 1949 varied from Delaware, with 71,881,000 (largest producing state), to Vermont, with 480,000 (smallest producing state).

The average annual price per pound of broilers increased 40 per cent from 1935 to 1949, but the purchasing power decreased from 106 to 74.

The purchasing power of broiler prices has been below 100 for 37 per cent of the time since 1939.

Price in 1949 is only slightly related to the total number by regions.

Georgia, a large producing state, received the lowest average annual price in 1949 with one exception, Missouri. Arizona and Louisiana, both low-producing states, received the highest annual prices.

Broiler prices tend to follow the general price level.

Feed, chicks, and labor, in that order, are the highest costs of producing broilers.

A broiler producer may lose money growing broilers but have considerable cash to spend.

The year 1947 was less favorable than several preceding. One pound of chicken would buy less feed. The situation improved in 1948 and 1949.

The chicken-feed price ratio was least favorable during 1949 in the Pacific, South Atlantic, and East South Central regions and most favorable in the Middle Atlantic and East North Central regions.

Profit per broiler is small. Large numbers (10,000–13,000 per man) are required for reasonable returns.

For commercial broiler producers, broiler growing is a year-around job.

Twenty-two-ounce eggs appear desirable for broiler production.

Three- to three-and-one-fourth-pound broilers at about 14 weeks of age was considered a profitable combination for marketing in Delaware, 1947.

Four and four-tenths pounds of feed per pound of meat, mortality lower than 8 per cent, and 2 man-hours or less daily per 1000 broilers were considered efficient in 1946 and 1947 in Virginia.

The number of broilers grown increased more than 1330 per cent from 1934 to 1949 in the United States. This period of 16 years has witnessed an expansion in the number of pounds of broilers grown of more than

1400 per cent. From 1934 to 1949 the yield of broilers plus the price advance per pound has stepped up the *gross income* in dollars from broiler production to the startling figure of over 2000 per cent, the index (1935–1939 base) from 48 to 1064, and the purchasing power from 52

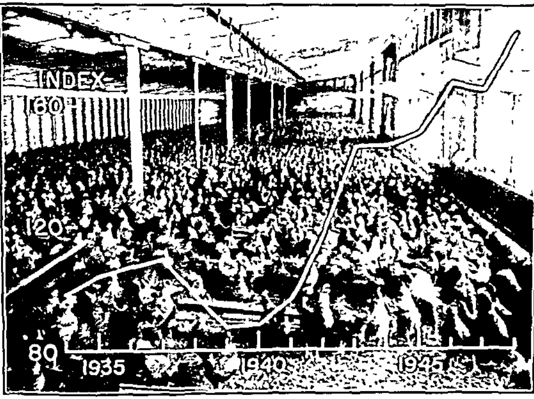

Fig. 90. Index of United States broiler prices. 1934–1948 (1935–1939 = 100). The index and purchasing power dropped in 1949 See Fig. 94

to 551. This phenomenal growth and financial situation appears largely to be the result of several factors, such as:

Rapid turnover of capital.
The opportunity for profit.
Increased growth rate resulting from research findings in feed efficiency, animal-protein factors, energy, and antibiotics.
Favorable consumer reaction to methods of preparation and marketing of an exceedingly appetizing meat and desirable meat-price comparisons.
Increasing population.

The amount consumed per capita was 3.7 pounds more in 1949 than in 1930, or 17 per cent greater. Consumption dropped in 1934 to 18.8, thus making the increase in per capita consumption, from 1934 to 1949, 34 per cent. Consumption dropped to a record low of 16.8 pounds in 1938 and reached its highest point in 1943 at 30.5 pounds. Both these figures apply only to the civilian population. Twenty-five pounds of

broilers over 365 days is probably still a small percentage of the total meat consumed, but it is more than half the number of pounds of eggs that each person consumed in 1949. During that year the per capita consumption of eggs was 376 which, at 1¾ ounces each, is 41.1 pounds of eggs, more or less. In 1945 consumption of eggs per capita reached the highest point, whereas consumption of chickens per capita declined slightly after 1943.

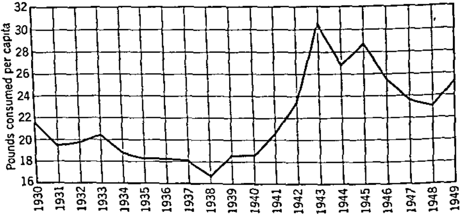

Fig. 91. Consumption of chickens per capita in the United States, 1930–1948 (dressed weight). These figures apply only to civilian population Consumption has increased since the low point in 1938. The trend since 1943 is downward.[1] (*Source: U.S.D.A. Agr. Statistics, 1950*)

The great strides that were made in commercial broiler production in the United States between 1934[1] and 1949[2] are shown in Table 113.

Table 113

Region	*Production in Thousands* 1934	1949
South Atlantic	13,200	254,293
South Central	5,500	91,265
North Atlantic	6,360	58,613
North Central (East N C and West N.C)	7,400	53,527
Western	1,570	29,391
United States	34,030	487,089

The South Atlantic states maintained their lead during these years. The North Central regions, east and west, dropped from second to fourth place; the South Central region, largely as the result of increased production by Arkansas, moved from fourth to second place. The North Atlantic regions continued in third place.

Broiler Production by Regions and States

The South Atlantic states from Delaware to Florida comprise the greatest producing area in the United States. It contains the Del-Mar-Va, Shenandoah, and Georgia areas, which are the three largest

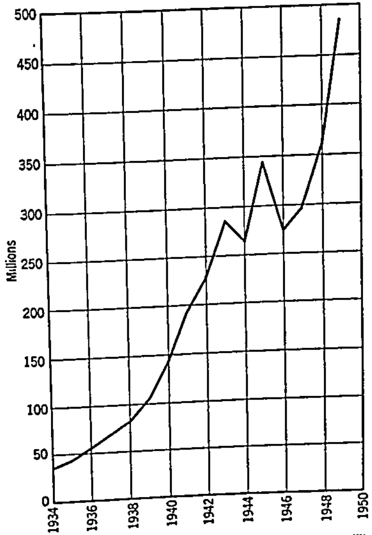

Fig. 92. Broiler production in the United States, 1934–1949 The number of chickens raised for broilers only has increased rapidly since 1934, and includes young chickens of the heavy breeds to be marketed at 2–4 pounds, live weight, and from which no pullets are kept for egg production These figures are not included in farm production of chickens (*Source*: *U.S.D.A. Agr Statistics*, 1950)

producing sections. Parts of Delaware, Maryland, Virginia, West Virginia, and Georgia are included in these sections. In addition, North Carolina produces a large number. The favorable conditions along the Atlantic Seaboard that are conducive to 64 per cent of the United States production of broilers are: (*a*) markets; (*b*) climatic conditions;

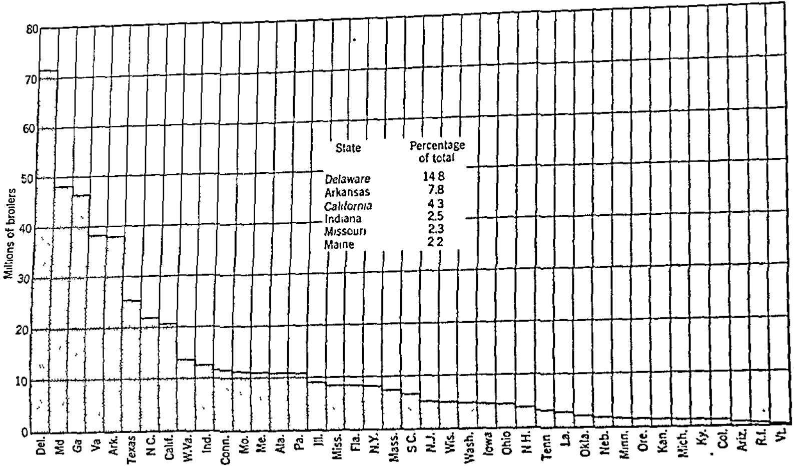

Fig. 93 Commercial broiler production, 1949, arranged high to low, by states. Total for the United States: 457,080,000. (Source: *U.S.D.A. Agr. Statistics,* 1950.)

(*c*) soil; (*d*) nearness to market; (*e*) availability of rugged breeding stock; (*f*) credit; (*g*) labor supply.

The South Central region includes the heavy producing state, Arkansas. Texas, with its great size, produced more than 25 million broilers in 1949. These two states accounted for more than 63 million of the 91 million credited to this region.

In the North Atlantic region Connecticut led in 1949 with nearly 12 million. Maine was next with more than 10.5 million, and Pennsylvania was third with 10.4 million.

Indiana and Illinois led in the East North Central region with 12.3 million and more than 9 million, respectively.

California produced 20.8 million broilers out of the total of more than 29.3 million in the Western region, and Missouri and Iowa made up 16 million of the 21 million broilers produced in the West North Central region.

Broiler Prices

The average annual price per pound for broilers in the United States for 1934 was $0.193. In 1948 it had risen to $0.359, an 86 per cent increase. In 1949 the price dropped to $0.28. With the exception of 1937 to 1941 inclusive, the price advanced steadily until 1949, and 1943 showed an increase of nearly $0.06 per pound over 1942. During the World War II years and after, the price was well sustained and advanced $0.073 from 1943 to 1948. This gain was lost in 1949.

In 1949 (Table 114), the regional average annual price per pound

Table 114

Region	*Price per Pound*	*Relative Standing in Numbers of Broilers Produced*
Western	$0.312	5
East North Central	0.303	4
South Central	0.288	2
North Atlantic	0.283	3
South Atlantic	0.273	1
West North Central	0.263	6

appeared to bear some relation to the number of broilers produced per region, the price being higher as the numbers decreased. Exceptions are the South Atlantic region which had the greatest numbers and next to the lowest price, and the West North Central region which had the lowest average annual price but was sixth in numbers produced.[2] The price differential was not great, although sufficiently large to bring

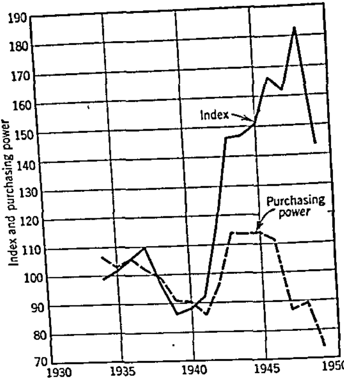

Fig. 94. Index and purchasing power of the annual price per pound of broiler in the United States, 1934–1949 (1935–1939 = 100). The index rose rapidly from 1941 to 1948. The purchasing power has been below 100 half the time and has dropped since 1945. (*Source: U.S.D.A. Agr. Statistics,* 1950.)

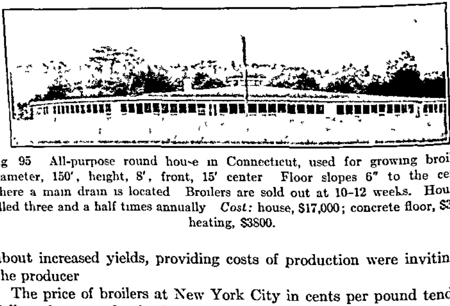

Fig. 95. All-purpose round house in Connecticut, used for growing broilers; diameter, 150′, height, 8′, front, 15′ center. Floor slopes 6″ to the center, where a main drain is located. Broilers are sold out at 10–12 weeks. House is filled three and a half times annually. *Cost:* house, $17,000; concrete floor, $3000; heating, $3800.

about increased yields, providing costs of production were inviting to the producer.

The price of broilers at New York City in cents per pound tends to follow the general price level. Variations occur, based on supply, demand, and quality. According to Fig. 96, Rock broilers have quite

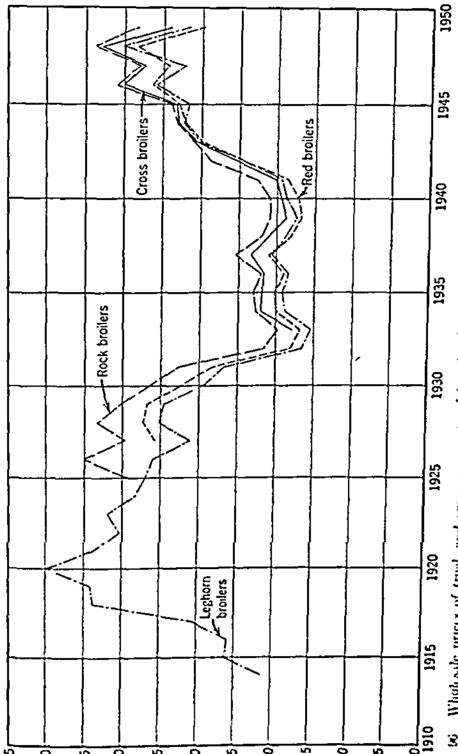

Fig. 96 Wholesale prices of truck and express receipts of live broilers on the New York City market, 1911–1950.[17]

consistently topped the market for live broilers at New York City, with the cross (Rock-Red) following closely. Leghorn and Red broilers have not varied greatly from each other. The high price in 1948 and the drop of several cents for each breed in 1949 is consistent with the general price level and the New York State farm price of eggs (Fig. 18).

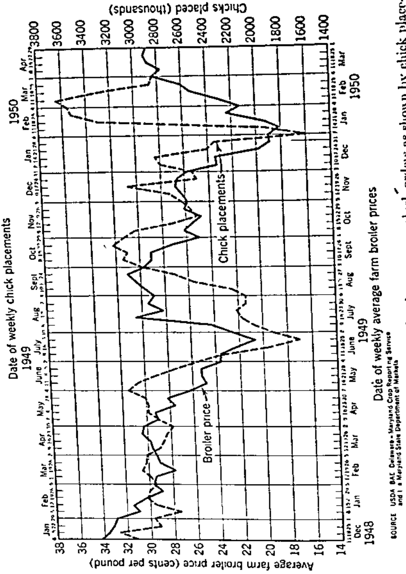

Fig 97 The effect of Del-Mar-Va farm broiler prices on chick orders as shown by chick placements 4 weeks later, 1910, and January, February, and March 1950.

Influence of Broiler Prices on Placements of Chicks

A graph is likely to show that the curve of chick placements follows the curve of chick prices of a few weeks earlier. The situation is similar to that of market eggs during the spring, for when prices are rising orders for chicks increase, but, when prices are falling, interest drops, and chick orders decline. Twelve to fifteen weeks later, in the case of

broilers, should the price rise because of a shortage of broilers, the individual producer has too few to sell. The high price then prevailing encourages the purchases of chicks which are ready for market along with many others and at a time when prices may be depressed.

This tendency is shown by Gwin [3] for the Del-Mar-Va area, from December 1948 to March 1950. Although there are exceptions, due to influencing factors, there is a tendency for value of chick placements and broiler prices to move together (Fig. 97). The broiler producer is likely to do as well, if not better, over a period of years if his investment is constantly used to capacity.

Costs of Growing Broilers

One hundred seventy Maine producers, who raised 308 lots of broilers during the war year ending June 30, 1944, had average costs of $0.243 per pound of meat produced and $0.95 per broiler sold. The highest cost was feed; next were chicks and labor. Labor included that hired and the estimated value of family and operator, whether paid or not. Chicks were charged at regular prices if hatched on the farm. Costs for buildings and equipment include estimated depreciation, taxes, and a 5 per cent interest on the investment. Miscellaneous costs include fuel, litter, light, power, disinfectant, medicine, and credit charge (Table 115).

Table 115. Costs and Returns in Producing Broilers on 170 Maine Farms for the Year Ending June 30, 1944 [1]

	Costs and Returns per		
	100 Broilers Sold	*Pound of Meat*	*Percentage of Total*
Costs			
Feed	$ 60	$0.153	62.9
Chicks	14	0.035	14.4
Labor	13	0.034	14.0
Buildings and equipment	4	0.012	4.9
Miscellaneous	4	0.009	3.8
Total	$ 95	$0.243	100.0
Returns			
Broilers sold	$112	$0.288	98.8
Broilers used	1	0.001	0.5
Manure *	1	0.002	0.7
Total	$114	$0.291	100.0
Net return or profit	$ 19	$0.048	
Labor return †	32	0.082	

* Estimated value of manure recovered from the brooder house.

† Gross receipts minus all costs except labor.

The Maine Survey results were checked with 76 lots on which records were kept by a large feed dealer in Maine for a similar period. The results of both surveys are much alike (Table 116).

Table 116. Comparison of Production Factors, Costs, and Returns for 308 Lots of Broilers Raised on 170 Survey Farms, and for 76 Lots for Which Records Were Kept by a Large Feed Dealer in Maine, Year Ending June 30, 1944 [1]

	308 Lots in Survey	*76 Lots of a Feed Dealer*
Number of chicks started per lot	1956	1692
Number of birds sold per lot	1730	1532
Percentage mortality	11.5	9.4
Age at sale, weeks	14.6	13.6
Weight at sale, pounds	3.9	3.4
Feed per bird, pounds	17.7	14.3
Feed per pound of meat, pounds	4.5	4.2
Daily gain per 100 birds, pounds	3.8	3.6
Cost of feed per pound of meat	$0.153	$0.159
Price per pound of meat	$0.289	$0.289

Table 117. Summary of Costs and Returns on 293 Lots of Broilers Raised on 104 Farms, Rockingham County, Virginia, 1946–1947 [4]

	Costs and Returns per				*Percentage of Total*
	Farm	*Lot*	*100 Birds Sold*	*Pounds Sold*	
Costs					
Feed	$3316	$1177	$ 67.80	$0.212	67.2
Chicks	780	277	16.00	0.050	15.8
Labor	452	160	9.20	0.029	9.2
Miscellaneous *	189	67	3.90	0.012	3.8
Buildings and equipment	141	50	2.90	0.009	2.9
Interest on operating capital	53	19	1.10	0.003	1.1
Total	$4931	$1750	$100.90	$0.315	100.0
Returns					
Broilers sold	$4811	$1707	$ 98.40	$0.308	97.2
Feed bags	67	24	1.40	0.004	1.4
Manure credits	73	26	1.50	0.004	1.4
Total	$4951	$1757	$101 30	$0 316	100 0
Net gain	$ 20	$ 7	$ 0.40	$0 001	
Return to labor	472	167	9 60	0.030	

* Includes fuel, litter, auto, truck, and team costs, and minor items.

For the year ending September 30, 1947, the Virginia Agricultural Experiment Station surveyed 101 farmers in the broiler-producing area of Rockingham County. Figures on 293 lots were included. Costs of production averaged \$0.315 per pound sold. The average return was \$0.316. The net gain was \$7.00 for each lot, \$0.40 per 100 birds sold and \$0.001 per pound sold. Labor returns averaged \$167 per lot, \$9.60 *per 100 birds sold, or \$0.03 per pound sold* (Table 117).

One may wonder how a business can continue with a profit of only \$0.001 per pound. The answer may be that miscellaneous costs are seldom considered, as litter, auto, truck, and team are on hand anyway whether or not they are used for broilers. Buildings and equipment likewise are often paid for and interest is not considered. Often these items do not require cash outlay. Furthermore, any family or operator labor is not likely to be paid as such. Actually, an operator on certain enterprises may receive a small wage, but the cash in pocket may be fairly generous.

Most producers are interested in cash costs and returns. *The chief items of cost are feed and chicks. Labor, if hired, is also* considered important. In many cases the enterprise is considered satisfactory on the basis of the return left after paying these two or three costs.

In West Virginia [6] 108 broiler producers were interviewed during the summer of 1946, and data for 1945 were obtained (Table 118). These data were supplemented by those assembled from broiler contractors * of that area on feed, mortality, sales, and financing for 269 broods of broilers raised in 1945 by 117 producers. During the period of this survey "the marketing and pricing structure was considerably disrupted by black markets and by the activities of the Office of Price Administration."

Eighty-six per cent of the total costs of raising broilers was in feed and chicks. Although heavy-feeding is essential, it appears that more attention to preventing waste of feed might prove financially desirable. Chick cost is important. Labor is a small proportion of the total cost.

Data on 120 lots of broilers for the Selbyville, Dagsboro, and Seaford areas of Delaware [6] were obtained for the period February 1 to September 15, 1946. Costs were found to be \$891 per 1000 broilers (Table 119).

* A broiler contractor is a feed dealer, feed mill, poultry dealer, huckster, or other individual or concern who furnishes feed, chicks, medicine, litter, insurance, and fuel to farmers who raise broilers for him under some form of contract arrangement

Table 118. Costs and Returns in Producing Broilers on 108 Farms in Northeastern West Virginia, Calendar Year, 1945 [5]

	Costs and Returns per 1000 Chicks Started	Costs and Returns per Broiler Sold	Costs and Returns per Pound of Broiler Sold	Percentage of Total
Costs				
Feed	$477.98 [a]	$0.552	$0.167	66.7
Chicks	138.66	0.160	0.048	19.3
Man labor	30.96 [b]	0.036	0.011	4.3
Fuel	26.74	0.031	0.009	3.7
Repairs and depreciation on bldg.	11.46	0.013	0.004	1.6
Repairs and depreciation on equip.	11.25	0.013	0.004	1.6
Transportation	6.61 [c]	0.008	0.002	0.9
Interest on investment	5.98 [d]	0.007	0.002	0.8
Litter	5.82	0.007	0.002	0.8
Electricity	1.24	0.001	[e]	0.2
Real estate and property taxes	0.69	0.001	[e]	0.1
Total	$717.30	$0.829	$0.250	100.0
Returns				
Broilers sold	$805.95	$0.931	$0 281	95.5
Manure	35.52	0.041	0 012	4.2
Broilers used on farm	2.51	0 003	0.001	0.3
Total	$843.98	$0 975	$0.294	100.0
Net return or profit	$126 59	$0.146	$0.044	
Labor return	157.55	0.182	0.055	

[a] Includes costs of medicine and disinfectants which amounted to 1 per cent or less of this figure when it was possible to separate them Also includes a hauling charge of $0.10 per 100 pounds. This, however, is offset in most instances by a credit of $0.10 per empty bag returned

[b] Computed at $0.40 per hour, which was the prevailing rate for day labor in the area.

[c] Includes use of both auto and truck for broiler enterprise Part of transportation expense is combined with feed cost Some producers had no direct transportation expense

[d] Computed at 6 per cent on half the original investment in buildings and equipment

[e] Less than $0.0005.

The same bulletin offers a chart (Fig. 98) from which, since the feed cost per hundredweight and the cost of chicks per hundred is known, the approximate current costs of growing 1000 broilers weighing 3.1 pounds each may be found.

Table 119

	Per Lot	*Per 1000 Broilers*	
Feed	$7079	$650	72.9%
Chicks	1128	104	11.7
Labor *	714	66	7.4
Medicine †	241	22	2.5
Fuel	158	14	1.6
Building costs ‡	122	11	1.2
Equipment costs ‡	113	10	1.1
Litter	61	6	0.7
Miscellaneous	92	8	0.9
Total	$9708	$891	100.0

* Value of operator's time, family labor, and hired labor.
† Drugs, vaccines, and labor administering vaccines.
‡ Repairs, depreciation, insurance, and interest on capital.

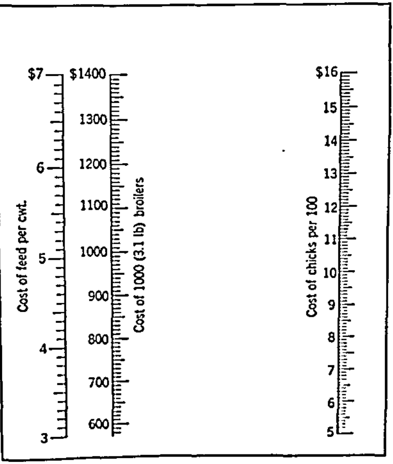

Fig. 98. Chart for determining the current total cost of producing broilers in Delaware. A ruler is laid on the figures showing the cost of feed and chicks. The broiler cost will be where the ruler crosses the broiler column. (*Source: Univ. of Del. Bull.* 270, 1947.)

West Virginia Bulletin 338 has compared the feed, chick, and labor costs in five other states with those of the West Virginia 1945 survey (Table 120). The variation in percentage of feed cost to total costs is 18.6 per cent, Delaware being highest. Chick cost varied 13.4 per cent and labor 9.7 per cent. The maximum variation among the three costs combined is 10.1 per cent. The ten years for which figures are presented will account for some of this difference. The location and its influence is important. The availability of feed, chicks and labor may be a matter of some importance to the broiler grower.

Detailed records were studied in Indiana [10] for 1946–1948 on 264 broiler flocks in the concentrated broiler areas of southern (Table 121) and northeastern Indiana. The records were taken by hatcherymen, feed and equipment dealers, and the buyers of broilers. Where estimates had to be made rates were used comparable to those in previous and contemporary studies at Purdue University. Rates and charges were used in accordance with the following quotation from *Bulletin* 539.

> Unpaid labor was charged at 55 cents per hour in Southern Indiana and 65 cents in Northern Indiana. Little hired labor is utilized in the Indiana broiler enterprise. A charge of 12 per cent of the estimated current value of stationary buildings and 20 per cent of portable buildings was made to cover repairs, depreciation, insurance, interest, and taxes. The charge for use of equipment includes estimated annual cost and interest on investment charged at 5 per cent. Interest at 5 per cent was charged on ½ of the cost of chicks and ½ of the total feed bill for the growing period of three months. A charge of 10 per cent of all other expenses was made to cover use of land, gross income tax, personal property tax, broiler use of horses, truck, auto, etc., and miscellaneous farm charges not readily assessible against the broiler enterprise. Cobs, shavings, sawdust, etc., were charged at the hauling cost wherever they were otherwise free. Farm-grown straw used for bedding was considered to have been used without cost (other than labor) since it was recovered in the litter.
>
> Credit for home-used broilers was made at the average weight and price received for other birds from the flock when sold. Credit for manure was based upon fertilizing values at current rates and excretion at rates suggested in *Poultry Nutrition*,* Third Edition, page 1357. This was estimated to be $5.50 per thousand chicks started. Where manure was given to labor for cleaning the house, compensating entries were made: a credit for manure balancing a charge for labor. Credit for feed sacks was set arbitrarily at $5.00 per ton in Northern Indiana and $3.00 per ton in Southern Indiana. The difference results from different sacks in use. The credit was reflected in a reduction in feed costs.
>
> * W. Ray Ewing, *Poultry Nutrition*, 3rd edition, 1947, Pasadena, Calif.

Table 120. Feed, Chick, and Labor Costs of Producing Broilers in Selected States during Various Periods [4]

	Maryland [7] 1934–1936	Indiana [8] 1936–1937	Maryland [7] 1941	Maine [1] 1944	West Virginia [5] 1945	Delaware [9] 1940
	Production Costs in Percentage of Total Costs					
Feed cost	54.3	54.3	60.4	62.9	66.7	72.9
Chick cost	25.1	19.8	18.6	14.4	19.3	11.7
Labor cost	8.6	7.8	10.3	14.0	4.3	7.4
Total	88.0	81.9	89.3	91.3	90.3	92.0
Number of broods	—	141	—	308	269	120
Number of broilers	1,962,202	165,374	—	602,488	453,940	1,495,680

Table 121. Costs and Returns per 1000 Broilers Sold, 264 Broiler Flocks in Southern Indiana, 1946–1948

Number of flocks	264
Average number of chicks started	6100
Average number of broilers sold	5383
Expenses	
Feed, net *	$593
Chicks	166
Labor	47
Buildings and equipment	31
Fuel and electricity	30
Interest and insurance	10
Capettes †	5
Litter	3
Disinfectant	12
Overhead	89
Total expenses	$977
Receipts	
Broilers, sold	$1009
Broilers, home use	7
Manure credit	6
Total receipts	$1022
Net returns per 1000 birds sold	$45
Man-hours per 1000 birds sold	89
Net returns per man-hour	$ 0.77
Labor returns per 1000 birds ‡	92.
Labor returns per hour ‡	1.31

* Net after credit for feed bags.

† Several flocks were treated with Capettes, a trade name for the synthetic female hormone, or estrogen, diethylstilbestrol.

‡ Returns after all expenses have been charged except for labor.

Chicken-Feed Ratio *

The importance of feed in the costs of broiler production makes comparisons of interest (Table 122).

Table 122. Chicken-Feed Price Ratios

A. United States Averages

Year	Chicken-Feed Ratio	Year	Chicken-Feed Ratio
1939–1948 average	8.1	1945	8.9
1940	7.8	1946	7.7
1941	8.5	1947	6.5
1942	8.5	1948	7.0
1943	9.1	1949	7.7
1944	8.2		

B. By Geographic Divisions, 1949

Division	Chicken-Feed Price Ratio
New England	7.5
Middle Atlantic	8.5
East North Central	8.4
West North Central	7.4
South Atlantic	7.2
East South Central	7.4
West South Central	7.6
Mountain	7.6
Pacific	7 0
United States	7.7

Relation of Size of Flock, Mortality, and Labor Efficiency to a Successful Broiler Operation

The profit per broiler is small. Obviously a large number of broilers is essential if large returns are to be expected. In Delaware a two-man flock, or 20,000 to 25,000 birds, is considered minimum size for reasonably good returns. Larger flocks mean more broilers per man, and less equipment, and often less investment in buildings per 1000 broilers, and no greater percentage mortality necessarily (Tables 125, 126). The larger flock also carries the possibility of greater loss in the event that something goes wrong. This fact may prove an added incentive to provide the management conducive to desirable results sometimes lacking in the care of a small, relatively low-profit enterprise.

* Number of pounds of poultry ration equivalent in value at local market prices to 1 pound of chicken, live weight. Simple average of monthly ratios. *U.S.D.A. Bureau of Agr. Economics.*

Size of Business

Table 123. Relation of Size of Flock to Costs and Returns,[10] 264 Broiler Flocks in Southern Indiana, 1946–1948

	Size of Flock		
	Under 5000	*5000 to 9999*	*10,000 to 21,500*
Number of flocks	125	90	49
Average number of chicks started	3158	6374	13,097
Average number of broilers sold	2811	5691	11,379
Expenses			
Feed, net *	$593	$597	$585
Chicks	166	165	166
Labor	56	42	31
Buildings and equipment	32	32	48
Fuel and electricity	33	30	23
Interest and insurance	10	11	10
Capettes †	4	4	10
Litter	4	3	3
Disinfectant	3	2	2
Overhead	90	89	86
Total expenses	$991	$975	$944
Receipts			
Broilers, sold	$1010	$1007	$1008
Broilers, home use	10	6	4
Manure credit	6	6	6
Total receipts	$1026	$1019	$1018
Net returns per 1000 birds sold	$35	$44	$74
Man-hours per 1000 birds sold	111	77	55
Net returns per man-hour	$ 0.51	$ 0.61	$ 1.66
Labor returns per 1000 birds ‡	91.00	86.00	104.00
Labor returns per hour ‡.	1.04	1.19	2.22

* Net after credit for feed bags.

† Several flocks were treated with Capettes, a trade name for the synthetic female hormone, or estrogen, diethylstilbestrol.

‡ Returns after all expenses have been charged except for labor.

The value of and the investment in any individual broiler is small. When a bird dies and the investment in that bird is divided among the survivors, the effect is of little consequence. However, each bird lost decreases the profit from each survivor. The disastrous results of heavy mortality may be readily seen (Table 125).

Labor, the third-highest cost in broiler production, may be higher per hour, but low or high per 1000 broilers. This difference among indi-

Table 124. Relation of Size of Flock to Costs and Returns, 293 Lots of Broilers, Rockingham County, Virginia, 1946–1947 [a]

	Size of Lots Started			
	Less than 800	800–1799	1800–2799	2800 or More
Number of lots	42	133	60	58
Average size of lots	511	1164	2129	4534
Percentage mortality	9.5	9.7	10.2	10.9
Age at sale (weeks)	13.6	13.6	13.1	13.9
Weight at sale (pounds)	3.2	3.2	3.2	3.2
Pounds of feed per pound of meat	4.4	4.3	4.3	4.4
Labor daily per 1000 started (hours)	4.1	2.4	1.8	1.2
Returns per pound	$0.322	$0.313	$0.320	$0.316
Costs per pound	0.365	0.328	0.312	0.304
Net gain per pound	−0.043	−0.015	0.08	0.012
Returns per man-hour	0.177	0.314	0.637	0.797
Net gain per lot	−65.00	−49.00	49.00	157.00

Mortality

Table 125. Influence of Mortality on Costs and Returns in Producing Broilers in Delaware, February 1–September 15, 1946 [a]

Mortality Range (Per Cent)	Broilers per Lot	Costs per Pound *	Net Returns † Per Pound	Net Returns † Per 1000 Broilers
Lots with 10,999 broilers or fewer started per lot				
0– 8.9	6,709	$0.284	$0.054	$170
9–14.9	7,815	0.298	0.050	145
15 and over	7,472	0.317	0.025	78
Lots with 11,000 broilers or more started per lot				
0– 8.9	16,830	$0.273	$0.075	$228
9–14.9	18,518	0.298	0 051	176
15 and over	17,766	0.316	0.080	38

* Including value of operator's time

† Total returns less total expenses, including value of operator's time.

vidual producers for the same year varied in Virginia from 1 hour to 4.1 hours daily per 1000 birds started (Table 124). In that survey, reported by Plaxico in 1948, each ½-hour saving in labor daily per 1000 broilers resulted in a reduction of $0.008 per pound produced. In Delaware an increase of 1000 broilers per man was accompanied by $0.002 less per pound in the cost of production. It was also shown that each

increase of 1000 broilers to the size of flock reduced the daily labor required for 1000 broilers by 0.7 hour.

It was found in Indiana that largest labor requirements per bird were with smaller flocks and that the smallest amount of labor per bird was in flocks averaging 4 times as large (Table 123). Nearly as much travel is needed and a tendency to spend more time in watching the chicks prevails when flocks are small. Location of feed storage and watering devices, and methods of transporting feed are likely to be more efficiently organized by large flock operators.

Table 126. Range in Mortality per Flock as Related to Flock Size in 264 Broiler Flocks in Southern Indiana, 1946–1948 [10]

Range in Mortality (Per Cent)	*Under 5000* *Number*	*Under 5000* *Per Cent*	*5000 to 9999* *Number*	*5000 to 9999* *Per Cent*	*10,000 or More* *Number*	*10,000 or More* *Per Cent*	*All Flocks* *Number*	*All Flocks* *Per Cent*
0– 5	42	34	23	25	5	10	70	26
6–10	37	30	36	40	19	39	92	35
11–15	24	19	15	17	13	27	52	20
16–25	14	11	11	12	7	14	32	12
26–59	8	6	5	6	5	10	18	7
	125	100	90	100	49	100	264	100

Size of Flock

Labor Efficiency

Clarke [5] reports from West Virginia that labor was used more efficiently as the number of broilers increased. The man-hours used in cleaning and preparing broiler houses and equipment and in feeding and tending decreased per 1000 broilers started as the size of flock increased, in northeastern West Virginia, 1945.

Broods per Year	*Producers*	*Broilers Started, 1945*	*Man-Hours per 1000 Broilers Started* *Cleaning and Preparation*	*Feeding and Tending*	*Total*
1	4	6,100	28.69	191.09	219.78
2	27	155,000	22.20	74.69	96.87
3	45	130,800	26.16	42.68	68.84

Plaxico of Virginia in 1946–1947 found the average labor requirements to be 167 hours per 1000 broilers started. The distribution of labor is shown in Table 127.

Table 127

	Man-Hours per 1000 Broilers Started	Percentage of Total
Preparing houses	22.7	13.5
Changing litter	2.6	1.6
Chores	140.8	84.3
Marketing	0.8	0.5
Other	0.1	0.1
Total	167.0	100.0

A 1946–1948 survey in southern Indiana showed highest labor efficiency in large flocks (Table 128).

Table 128

	Labor per Flock		
	Greatest 10%	Lowest 10%	All Flocks
Range in hours per 1000 birds	150–326	23–45	23–326
Number of flocks	28	27	264
Average hours required	192	37	89
Size of flock	3385	12,288	6100
Percentage mortality	14	11	11
Cost per pound of broiler sold	$0.366	$0.325	$0.337
Net returns per pound sold	0.016	0.018	0.016
Labor returns per hour	0.24	2.30	1.31

Bausman[6] states that apparently a minimum of 13,000 broilers per man is required for good management and supports the claim with figures from February 1–September 15, 1946 (Table 129).

Table 129

Number of Broilers Started per Man		Number of Lots	Number of Broilers Started per Lot	Percentage Mortality	Cost per Pound *	Net Returns †	
Range	Average					Per Pound	Per 1000 Broilers
0– 7,999	6,787	29	8,796	12 0	$0 302	$0 039	$118
8,000– 9,999	9,018	28	10,022	13 7	0 296	0 042	129
10,000–11,999	10,906	39	14,314	13 1	0 290	0.048	148
12,000 and over	13,195	24	16,741	14 1	0 286	0 060	199
Averages	9,977	120 (total)	12,464	13 1	0 296	0 047	147

* Including value of operator's time.
† Total returns less total expenses including value of operator's time.

Investment for Broiler Growing

Items required are land, buildings, stoves or heating units, feed hoppers, waterers or water systems, feeding and cleaning equipment,

lighting facilities, disinfectant and spraying or other equipment, operating capital, and the like. Occasionally range shelters are used.

One enterprise may have a low investment in watering devices, for example, but may have increased labor costs to make up for it. Wells, hand pumps, electric pumps and pressure tanks, hand-filled containers,

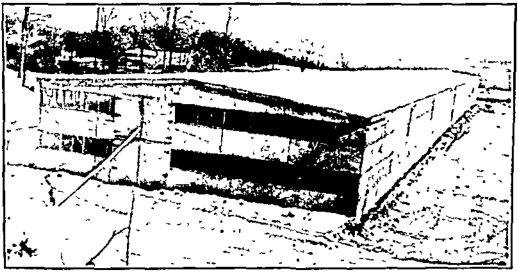

Fig. 99. All-purpose house, 50′ x 440′, 2-storied, used for growing broilers or as a complete unit in the 12-month laying system. House accommodates 44,000 broiler chicks at 1 square foot of floor space per chick or 11,000 layers at 4 square feet per bird. Cellophane windows. Slot ventilation in front, 10 electric fans in back. Walls of 1¾″–2″ cement asbestos celotex board. Roof is the same with built-up roof above the board. Building cost, $0.55 per square foot. (*Courtesy Professor Roy E. Jones, Univ. of Conn., Storrs, Connecticut.*)

and automatic watering are examples of variations to be found in equipment.

In Gonzales County, Texas, in 1943,[11] the average investment per 1000 chick capacity was $390 (Table 130).

Table 130

	Per Farm	*For 1000-Chick Capacity*	*Proportion of Total Investment*
Average investment			
Land (11.7 acres per farm)	$ 410	$ 37	9.5%
Improvements			
Broiler houses	1813	165	
Water system	434	39	
All other improvements	857	78	
Total, all improvements	3104	282	72.3
Equipment	692	63	16.1
Workstock	90	8	2.1
Total	$4296	$390	100.0%

The investment in equipment amounted to nearly $700 or about 16 per cent of total investment. Common items of equipment for each house of 1000 chick capacity included 2 brooders, 6 or more small feed troughs, 6 large feed troughs, 2 feed barrels, 10 to 12 water fountains, and 2 water troughs with floats. Spraying equipment, small tools and a trailer or cart for hauling feed were other items usually included.[11]

In Maine[1] the average investment per farm in broiler equipment, land, and buildings is listed as $825, or $23 per 100 chicks started.

	Per Cent
Brooder house	72
Brooder stove	10
Water system	6
Feed hoppers	4
Range	4
Water containers	3
Range shelter	1
	100

Plaxico[4] lists about the same amount per 100 broilers started and adds operating capital:

		Per Cent
Buildings	$20.08	45.5
Equipment	4.19	9.5
Operating capital	19 87	45.0
	$44.14	100.0

Season of Broiler Production

Formerly the broiler business was quite seasonal, but in 1952, because of the year-around demand and the reasonable regularity of price, broilers are raised continuously, three to four broods annually. Flocks are usually completely sold out at one time, and a period of 1–3 weeks elapses between broods. Such management assists in the control of respiratory diseases.

Relation of Egg Weight to Broiler Growth

Trials were conducted at the University of Delaware[12] with New Hampshires. Eggs from each weight class were placed in pedigree baskets to avoid mixing. Chicks were weighed at hatching and each week thereafter. Trials were conducted from October 10, 1946, to December 11, 1947. In Table 131 three trials under each egg-weight group are combined and the average of the three is shown.

Table 131. Relationship between Egg Weight, Chick Weight, and Subsequent Broiler Weight, Initial and Weekly Average Weights, University of Delaware, 1946–1947 [12]

Size of Eggs Set	Initial Chick Weight (Pounds)	Weight by Weeks (Pounds) 2	4	6	8	10	12
18 and 19 oz.	0.066	0.226	0.543	0.997	1.392	2.110	2.764
20 and 21 oz.	0.071	0.230	0.501	0.923	1.362	2.024	2.667
22 oz.	0.076	0.245	0.544	0.955	1.484	2.152	2.814
23 and 24 oz.	0.082	0.257	0.559	0.978	1.466	2.137	2.802
25 and 26 oz.	0.089	0.261	0.558	0.955	1.448	2.134	2.807
27 and 30 oz.	0.095	0.262	0.573	1.010	1.511	2.205	2.901

The initial weight of the chick and the 2-week weight increased as the egg weight increased. For the balance of the 12-week period the chicks from 18- to 19-ounce eggs surpassed in weight those from 20- and 21-ounce eggs. Chicks from 22-ounce eggs compared favorably with those from heavier eggs, and the conclusion is that "from a weight standpoint any size of egg from 22 ounces per dozen up will make satisfactory broilers."

Age Marketed

From 14 to 15 weeks appeared to be the most profitable age to market broilers in Delaware (Table 132).[6] The amount of feed per pound of weight increases rapidly after 15 weeks.

Table 132

Age Sold (Average Age, Weeks)	Broilers per Lot	Feed per Pound of Weight (Pounds)	Weight at Selling Time (Pounds)	Percentage Mortality for Period	Price Received per Pound	Costs per 1000 Broilers	Net Returns per 1000 Broilers
13.0	11,229	4.55	2.8	11 7	$0 334	$ 789	$149
14.2	12,592	4.46	3.0	10.9	0 34	842	161
15.2	13,190	4.63	3.1	12 8	0 341	903	148
17.0	12,979	4.98	3.3	16.8	0 355	1041	131

The Del-Mar-Va broiler should be marketed when it reaches 3 to 3¼ pounds, according to Harold Smith of the University of Maryland. Records showed that 2½-pound broilers might just about pay labor charges. The law of diminishing returns operates rapidly as birds approach 4 pounds in weight.*

* The 1950 and 1951 Chicken-of-Tomorrow tests indicate that the law may operate less rapidly as more efficient breeding and feeding materialize.

Breeds

Many hatching eggs from Maine find their way to broiler hatcheries in other sections. The breeds used there may reflect their general popularity.[1]

Broiler cross	60%
Rhode Island Reds	12
Sex-linked cross	10
New Hampshires	8
Plymouth Rocks	3
Mixed lots	7

Breed of Chicks Produced as Related to Breed Preference at the Dressing Plants in the Del-Mar-Va Broiler Region

There seemed to be considerable conflict between the producers, live poultry buyers and dressing plant buyers in regard to breed preference. In 1946–1947 90.1 per cent of all broilers produced were crossbreed. The survey of producers showed that they preferred the crossbreed because it seemed to have greater resistance to disease, made better utilization of feed consumed, and could be sold either on the live market or dressed market.

Breed	*Number of Chicks Hatched*	*Percentage of Total Salable Chicks*
Crossbreed	55,130,184	90.1
New Hampshires	4,034,934	6.6
Leghorns	915,000	1.5
Barred Plymouth Rock	107,700	0.2
Others	980,000	1.6
Total	61,167,818	100.0

A number of dressing plant operators were paying slightly more for New Hampshires. If this practice should continue there will likely be some shift in production from the crossbreed to the New Hampshire. Any change of this kind will likely be gradual, because the crossbreed has proven itself to producers many times.

Breed	*Number of Plants Preferring Each*
New Hampshire	10
Crossbreed	3
White Columbian or Columbian Cross	1
No preference	1

Plant managers listed New Hampshires as being preferable. About the only objectionable feature of the crossbreed is that of dark pinfeathers which cause difficulty in dressing plants.[11]

The *Chicken-of-Tomorrow* contest is securing maximum results in quick growth and effects of better rations. Such mottoes as 5-3-3 programs suggested by Wade Rice of the University of Maryland are being stressed: 5 = maximum mortality; first 3 = 3-pound average weight at 10 weeks of age; second 3 = 3 pounds of feed per pound of gain to 10 weeks (Table 133).

Table 133. Regional Results of the Chicken-of-Tomorrow Contest, 1950

	First		Second		Third	
Region	*Weight* *	*Variety*	*Weight* *	*Variety*	*Weight* *	*Variety*
North Central	4.71	White Cornish × White Rock	4.66	Cornish × New Hampshire	4.66	White Rock
Northeastern	5.00	White Rock	4.96	New Hampshire	4.54	White Rock
Southeastern	4.51	*Indian River Cross*	4.38	*Cornish × New Hampshire*	4.33	*Vantress Cross*
Southwestern	5.00	Vantress Cross	4.42	White Rocks	4.40	Vantress Cross
Western	4.89	New Hampshire	4.79	Cornish × New Hampshire	4.70	New Hampshire

* New York-dressed weight per bird at 12 weeks, pounds.

Chances are good that quicker gains, shorter growing periods, reduced costs, and greater profits are just ahead.

The 1950 contest continued the quest for pure breeds or crosses that will bring about maximum growth and weight of broilers at 12 weeks. The two top entries were from Arkansas and Connecticut, where the two contestants concerned submitted broilers averaging 5 pounds dressed. The Connecticut and Arkansas birds weighed 5.47 pounds and 5.27 pounds alive, respectively. A list of the varieties and crosses that appear among the fifty making up the ten winners of the five regions in the United States follows.

White Rocks	14
New Hampshires	11
Cornish-New Hampshire Cross	8
Vantress Cross	4
White Cornish-White Rock Cross	4
Indian River	3
White Cornish	1
Barred Rocks	1
Eisenbars	1
White Rock-New Hampshire Cross	1
Cornish-Barred Rock Cross	1
Barred Rock-New Hampshire Cross	1
Total	50

The first random sample poultry meat production test at the California Poultry Testing Project, Modesto,[15] held in 1950, consisted of an entry from each contestant of 100 chicks selected at random by an officially designated person from an entire day's hatch of the particular grade entered. The chicks were brooded and reared at the Modesto Testing Station. At 11 weeks the entry was New York-dressed and graded by a federal grader.

The net income per bird represents the average meat value per bird, less the cost of feed and the price per chick shown on the entrant's published price list. The average net income is an average of the net income per cockerel and the net income per pullet, and is used to adjust all entries to a 50-50 sex ratio.

The feed conversion ratio represents the pounds of feed required to produce a pound of live weight.

The Cornish-New Hampshire Cross was highest in average net income and second best in the feed required per pound live weight.

The first ten entries are summarized in Table 134.

Table 134

Breed	*Average Net Income*	*Feed Conversion Ratio*
Cornish × New Hampshire	$0.583	3.75
White Cornish × White Rock	0.546	3.82
Barred Rock × Rhode Island Red	0.526	3.84
New Hampshire	0.521	3.78
Barred Rock × New Hampshire	0.517	3.65
Barred Rock × New Hampshire	0.507	3.84
New Hampshire	0.505	3.75
Barred Rock	0.493	3.87
New Hampshire	0.483	3.93
Cornish × New Hampshire	0.482	3.83

The first Maine broiler test was inaugurated in October 1946, and "offered to breeders, hatcherymen, and broiler growers a measuring stick for commercial meat qualities." The fourth test was completed March 29, 1950 Its plan was similar to those of the first three tests. Eggs were selected three times annually from each pen comprising 26 pullets and 3 males entered for the purpose at the Maine Egg Laying Test This gave 150 eggs from each pen that were sent to the University of Maine for hatching. Ninety chicks were selected at random, divided equally as to sex, reared to 14 weeks, and then slaughtered. The variety and feed-broiler meat ratio for the first six producing most economically are listed in Table 135

Table 135

Variety		*Pounds of Feed Required for 1 Pound of Gain (Live Weight) Cockerels and Pullets Combined*
Male	*Female*	
Barred Plymouth Rock	New Hampshire	3.78
New Hampshire	New Hampshire	3.79
New Hampshire	New Hampshire	3.80
New Hampshire	New Hampshire	3.84
Barred Plymouth Rock	New Hampshire	3.85
New Hampshire	New Hampshire	3.86

Effect of Efficiency Factors on Costs and Profits in Broiler Production

Plaxico [4] lists four important efficiency factors as:

1. *Feed efficiency.* The dividing line was 4.4 pounds of feed per pound of meat. Below that figure net gains were made; above it, a loss was experienced.
2. *Rate of mortality.* Between 8 and 9 per cent appeared to be the critical point. Below resulted in a gain per pound; above 9 per cent, a loss.
3. *Labor efficiency.* Two hours daily per 1000 broilers was the dividing point between a gain or a loss per pound.
4. *Number started per lot.* Below 6500 broilers per farm, costs mounted too rapidly for the 1947 prices of about $0.315 per pound. A loss per pound of broiler resulted.

Other factors found important are:

Rate of growth. An increase in weight to 3.5 pounds was accompanied by decreased costs.

Age and weight at sale. Three pounds at 12 weeks gave the most profitable birds. Faster gains were made by heavier birds but at the expense of poor feed efficiency.

Shulze [16] has listed five important factors affecting net receipts.

1. Broilers per farm.
2. Broilers sold per man.
3. Feed-to-meat ratio.
4. Mortality.
5. Market age of broilers.

Table 136. Factors Better than Average Related to Costs and Returns, 293 Lots of Broilers, Rockingham County, Virginia, 1946–1947

	Factors Better than Average				
	None	*One*	*Two*	*Three*	*Four*
Number of lots	25	54	102	75	37
Average number started	921	1260	1403	2587	3753
Percentage mortality	18.9	15.2	11.8	9.7	5.9
Pounds of feed per pound of meat	5.2	4.5	4.4	4.4	4.1
Labor daily per 1000 started (hours)	3.3	2.5	2.1	1.4	1.2
Average weight at sale (pounds)	3.0	3.3	3.3	3.1	3.2
Average age at sale (weeks)	13.7	13.9	13.9	13.6	13.1
Returns per pound (cents)	31.8	31.3	31.2	32.3	31.3
Cost per pound (cents)	40.9	34.4	32.3	31.5	28.2
Net gain per pound (cents)	−9.1	−3.1	−1.1	0.8	3.1
Return to labor per hour (cents)	21.2	12.7	35.1	66.4	137.5

From a survey of 31 Massachusetts broiler producers taken in 1949, a table was constructed of the 4 farms measuring highest in the above factors, the 4 farms with lowest efficiency, and the average of the 31. The net cash returns * per broiler of the 4 high farms exceeded those of the low farms by $0.157 (Table 137). Considering averages, the 4 farms

Table 137. The Effect of Efficiencies on Net Cash Return

	4 Farms, High Efficiency	*31 Farms, Average Efficiency*	*4 Farms, Low Efficiency*
Broilers sold per farm	69,930	48,425	7085
Broilers sold per man	69,930	30,024	7085
Pounds of feed per pound of meat	2.96	3.03	3.59
Mortality	4.65%	7.73%	6.53%
Market age of broilers	12.3 wk.	11.7 wk.	12.7 wk.
Net cash return per broiler [a]	43.3¢	39.1¢	27.6¢

[a] Based on price relationships of the year 1948.

with the highest returns per bird excelled the 4 farms with the lowest returns per bird by (1) selling 62,845 more broilers annually; (2) handling 62,845 more broilers per man; (3) producing a pound of meat with 0.63 fewer pounds of feed; (4) having 1.88 per cent less mortality in the birds; (5) marketing the birds 0.4 week sooner.

* Net cash return per bird as used here is the difference between cash expenses and cash receipts.

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20 · The Turkey Industry

The high point in consumption of turkey per capita was reached in 1946 and 1947 with 4.5 pounds.

Between 1930 and 1945 turkey production increased nearly 159 per cent in the United States. Production dropped nearly 28 per cent from 1945 to 1948, then recovered in 1949 to within 2 million of the 1945 peak.

Fewer turkeys are consumed on farms where produced, since 1941 than before.

Gross income from turkeys in 1949 was $270 million, 427 per cent above that in 1930.

The gross income index increased from 77 in 1930 to 409 in 1949.

The purchasing power of the gross income increased from 72 to 212 from 1930 to 1949.

Turkey prices followed the general price level advancing rapidly from 1940 until 1949.

The index of turkey prices per pound, 1930–1949, increased from 115 to 202, but the purchasing power dropped in 1949 to below the 1930 figure.

The purchasing power of turkey prices reached a peak in 1944 and has been dropping since.

The Western region produces the most turkeys.

The South Central region, Kentucky to Texas, consumes more turkeys on farms than any other region.

California produced more turkeys in 1949 than any other state. Texas was in second place.

Nevada, in 1949, produced the fewest turkeys with Rhode Island a close second.

Small turkeys and highest prices per pound, live weight, were found in the East in 1948.

The cost of producing poults was slightly under $0.60 each in the 1940's.

The cost of keeping turkey breeders for a year was $7 to $8 each in the 1940's.

The cost of producing turkey hatching eggs was from $0.22 to $0.33 each in the 1940's.

Turkey growing requires a high capital investment.

Receipts should equal capital in 1 to 1½ years.

Feed, poults, and labor are the highest costs of producing turkeys.

From $0.75 to $0.79 of the consumer's turkey dollar goes into farm production.

Turkey production and consumption is generally increasing; 1946 and 1947 consumption per capita was 150 per cent of that in 1930, or 1.8 pounds to 4.5 pounds. In 1949 it had dropped back to 4.1 pounds per capita, or 128 per cent of that in 1930.

Production reached its high point (44 million) in 1945, dropped rapidly through 1948 to 32 million and increased to 42 million in 1949. In 1949

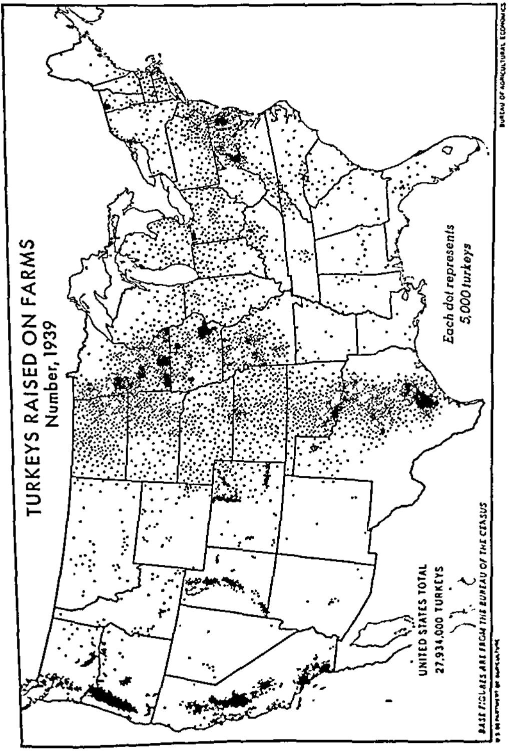
TURKEYS RAISED ON FARMS
Number, 1939
Each dot represents
5,000 turkeys
UNITED STATES TOTAL
27,934,000 TURKEYS
BASE FIGURES ARE FROM THE BUREAU OF THE CENSUS
BUREAU OF AGRICULTURAL ECONOMICS

Fig. 100.

production was 147 per cent above 1930. The number of turkeys eaten on farms where produced has increased slightly since 1945, but was less than half the number consumed in 1930, or a drop from 1,704,000 in 1930 to 798,000 in 1949. Gross income from the sale of turkeys reached its peak in 1946 with $274 million. In 1949, gross income was 427 per cent above the 1930 figure, reaching $270 million. Three factors are responsible for this cash increase:

1. Greater number of turkeys produced, 147%.
2. Increase in price per pound, 175%.
3. Rise in the general price level from 126 to 227, using 1910–1914 as the base, and from 107 to 193, using the 1935–1939 base.

Reference to Fig. 101 shows that the index of the gross income from turkeys increased rapidly up to and including 1946, and has since held

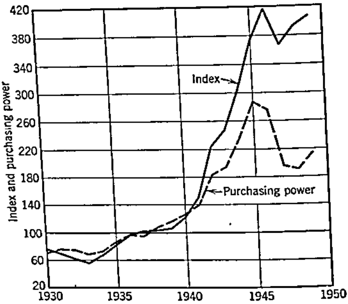

Fig. 101. Index and purchasing power of *gross income from turkeys* in the United States, 1930–1949 (1935–1939 = 100) (*Source: U.S.D.A. Agr. Statistics,* 1950.)

relatively high. The purchasing power of the gross income reached a high point in 1945 and has remained relatively high, although it was somewhat less favorable to 1949.

Highest production and gross income was found in the Western and West North Central regions in 1949. Turkey production in the other

four regions of the United States was fairly evenly distributed, with the North Atlantic states producing the least.

Producers in the South Central states of Kentucky to Texas are heavier turkey consumers than other regions. The states of Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, and Oklahoma combined in 1949 produced 1,306,000 turkeys, and 8 per cent of them were consumed on the farms where produced. The six New England states produced 803,000, and 2 per cent were consumed on the farms. The difference in annual price per pound was about $0.04 in favor of

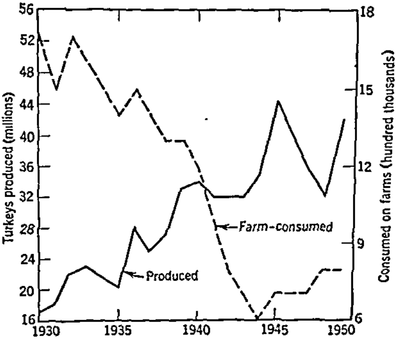

Fig. 102. Total farm production and farm consumption of turkeys in the United States, 1930–1949. From 1945 to 1948 the average annual price increased $0.131 as production fell and farmers ate more turkeys. Production increased in 1949 Farmers continued to eat their product, which dropped $0.115 per pound. (*Source: U.S.D.A.*)

New England. More turkeys are grown for home consumption in the South Central region, 4.2 per cent of those produced, than in any other region, the nearest competitors being the states in the South Atlantic region where 2.5 per cent of the production is consumed on farms where produced.

The farm production and consumption of turkeys in farm households, by regions, for 1949, arranged high to low in production, is shown in Table 138.[1]

Table 138

Region	*Number Produced* * (*Thousands*)	*Number Consumed on Farms* † (*Thousands*)
Western	12,697	187
West North Central	10,759	153
East North Central	5,098	57
South Central	5,468	231
South Atlantic	4,270	107
North Atlantic	3,374	63
United States	41,666	798

* Turkeys raised, less death loss during the year of breeder hens on hand, January 1.

† Turkeys consumed in households of farm producers.

Turkey Production by States

California was the largest producer of turkeys, with 6,792,000, in 1949. Utah and Oregon stood fifth and sixth in the nation and, with California, were the largest turkey-producing states in the Western

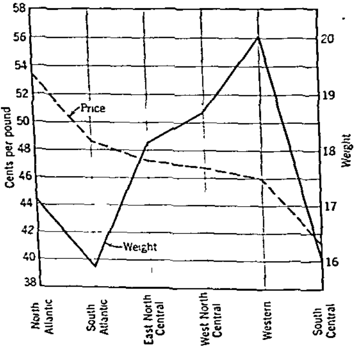

Fig 103 Live weight in pounds per bird of turkeys sold, and farm price per pound, by regions in the United States, 1948 Except in the South Central states the price generally dropped as the weight increased

region. Texas was first in the South Central region and second in the nation, with 4,162,000 turkeys produced.

The West North Central region had the third, fourth, and seventh ranking states of Minnesota, Iowa, and Missouri, respectively.

Virginia was eighth and Pennsylvania ninth, and they led in their regions, South and North Atlantic, respectively. In the East North Central region Indiana led, with Ohio and Illinois following closely.

Texas led in the number eaten on the farms where produced, with 125,000. California, although she produced many more, consumed 74,000 on the farms where produced and stood second among the states.

Price and Weight

Highest prices prevailed along the Atlantic Seaboard. Prices gradually diminished as one proceeded westward, except for the South Central states from Kentucky to Texas. This region sold its turkeys for the

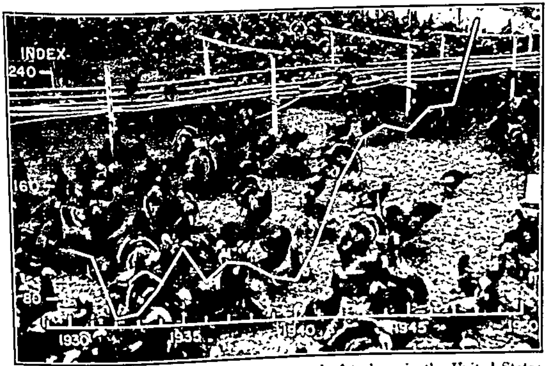

Fig. 101. Index of the annual price per pound of turkeys in the United States, 1930–1948 (1935–1939 = 100).

lowest price in the United States, and at weights only slightly above those in the South Atlantic states, which had the lowest weight per bird and the second-highest price.

Weights of 18 to 20 pounds are accompanied by a downward price trend (Fig. 103). Lighter turkeys were grown in the East where the better markets are found. Since 1939 the trend toward heavier turkeys

has been consistently upward in the United States (Table 139). Individual states have shown considerable variation.

Table 139. Average Live Weight of Turkeys Sold, United States, 1939–1949 [1]

Year	Hens (Pounds)	Toms (Pounds)	All (Pounds)
1939	11.9	17.9	14.9
1940	12.1	18.1	15.1
1941	12.7	19.1	15.9
1942	13.0	19.6	16.3
1943	12.9	19.5	16.2
1944	13.2	20.4	16.8
1945	13.5	21.4	17.4
1946	13.8	22.0	17.9
1947	13.8	22.4	18.1
1948	14.0	22.5	18.2
1949	14.2	23.2	18.7

The average annual United States farm price per pound increased 133 per cent from 1930 to 1948. In 1949 this price dropped \$0.115 and the purchasing power 26 points (Table 140, Fig. 105).

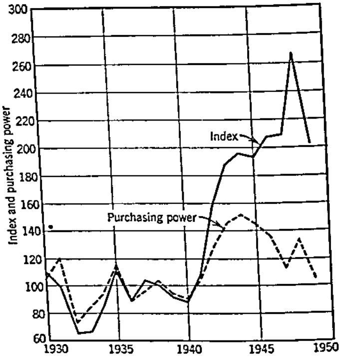

Fig. 105 Index and purchasing power of the annual farm price per pound of turkeys in the United States, 1930–1948, 1935–1939 base. The rapid rise in the general price level after 1940 was accompanied by a rise in turkey prices but by only a moderate rise in purchasing power. Both dropped in 1949, although the enterprise remained profitable.

Table 140. Average United States Annual Farm Price per Pound, Live Weight, of Turkeys, 1930–1949 [1]

Year	Farm Price per Pound	Year	Farm Price per Pound
1930	$0.20	1940	$0.154
1931	0.191	1941	0.199
1932	0.127	1942	0.275
1933	0.116	1943	0.326
1934	0.151	1944	0.340
1935	0.201	1945	0.336
1936	0.156	1946	0.362
1937	0.181	1947	0.364
1938	0.175	1948	0.467
1939	0.157	1949	0.351

Producing Turkey Hatching Eggs and Poults

Production costs for turkeys is on a vastly different basis than those for chickens. The cost of one turkey hatching egg may be comparable to the cost of nearly one-half dozen chicken market eggs, or 4 chicken hatching eggs.

Eggs Produced

The average production from one turkey breeding hen varies from 26 to 50 eggs. With good management birds should average 40 to 45 eggs each from March to June and, if artificial light is started in December and the season advanced 2 months, as many as 70 eggs per hen have been secured. The peak of egg production in central United States is likely to be reached during the week before and the week after April 1. A 52 per cent lay may be expected.

Should hatchability average 54 to 60 per cent, one can readily see that the cost of producing one poult is expensive. In Illinois in 1947, this cost was $0.58.[2] In New York for 1943, the cost was $0.528.[3]

The relation between the number of eggs and the profit per bird is close. The Illinois workers found two flocks producing below 23 eggs per breeder hen (these suffered losses) and two averaging over 43 with a profit per hen of $7.86. In 1947 those flocks averaging above 30 eggs made a profit of $6.51 per breeder hen.

The hatching season is short; therefore, every effort should be made to keep all birds laying and to obtain every egg possible by the use of lights, prompt breaking of broody hens, proper feeding, and otherwise managing hens and toms to secure maximum hatchability.

In 1947 eight turkey breeder farms, averaging 603 breeder hens, co-operated with the University of Illinois by keeping cost accounts on their breeding flocks.[2] These accounts started January 1, 1947, and

continued approximately 132 days, or until all of the breeding flock was sold. The flocks varied in size from the largest, 1663, to the smallest, 105 (Table 141).

Table 141

Cost of producing an egg	$0.28
Cost of producing a poult	$0.58
Net cost of keeping a breeder hen	$7.37
Feed consumed by 100 breeder hens (pounds)	8412
Eggs produced per hen (hatching season only)	26
Feed cost of 100 eggs	$12.78
Percentage of hatchability of eggs	54
Percentage mortality in breeder flock	13.80
Fixed capital in the plant per breeder hen	$1.58
Man-hours per 100 breeder hens	109

Cost per Turkey Breeder Hen and 100 Turkey Hatching Eggs, 1947 (Several States)

In *Illinois*[2] feed was the highest cost. Labor and mortality were similar. Mortality was a serious factor, possibly exceeding the labor cost. A loss of 13.8 per cent of the birds resulted in a cost of $0.86 for keeping a breeding hen when the loss was divided among the survivors (Table 142).

Table 142. Cost per Turkey Breeder Hen, Illinois, 1947[2]

	Average Flock
Average number of breeder hens per flock	603
Percentage mortality in breeder flock	13.8
Cost per bird	
Feed	$3.39
Labor	0.86
Mortality	0.86
Cost of hatching day-old poults sold	0.29
Other costs *	1.86
Total operating expense	$7.26
Interest on capital	0.21
Gross cost	$7.47
Deductions from cost †	0.10
Net cost	$7.37

* Includes such items as buildings, equipment, supplies, tractor, truck, horse use, turkey testing, disinfectants, range seed, interest paid on feed loans, association dues, and insurance on turkeys. Insurance received for losses in turkeys is credited in obtaining the mortality figure.

† Manure, sale of sacks, and increase of sales of breeders over opening inventory.

To produce 100 hatching eggs requires, with an average production of 26 per bird, nearly 3.8 breeding hens. The cost of producing 100 eggs is \$27.81 on the Illinois farms, or \$0.28 per egg (Table 143).

Table 143. Cost of 100 Turkey Eggs, Illinois, 1947 [2]

	Average Flock
Eggs produced per hen	26
Cost per 100 eggs	
Feed	\$12.78
Labor	3.23
Mortality	3.26
Other costs *	8.14
Total operating expense	\$27.41
Interest on capital	0.80
Gross cost	\$28.21
Deductions from cost †	0.40
Net cost	\$27.81

* Includes such items as buildings, equipment, supplies, tractor, truck, horse use, turkey testing, disinfectants, range seed, interest paid on feed loans, association dues, and insurance on turkeys. Insurance received for losses in turkeys is credited in obtaining the mortality figure.

† Manure, sale of sacks, and increase of sales of breeders over opening inventory.

A detailed cost study [6] in western *Oregon*, 1949, showed the "cost of producing turkey hatching eggs averaged \$14.64 per breeder bird, or *32.88 cents per egg sold for hatching during the 1949 season.* The 51,814 turkey hens included in this study produced an average of approximately 50 hatching eggs per hen at a net profit to the operator of ¾ of 1 cent per egg."

The net cost per hatching egg was greater in flocks of 1000 hens or more. The net cost per breeder was greater in flocks of 400 or fewer.

The average cost for 2,590,161 hatching eggs per egg is shown in Table 144.

In *New York* in 1943, 12 turkey farms were surveyed.[3] The cost of keeping a breeder was \$8.25 and of producing 100 hatching eggs \$21.70 or \$0.217 for each hatching egg. Feed, depreciation, and labor were the highest costs, in that order, representing 81.9 per cent of the total cost. The value of the 100 hatching eggs was \$21.13, or \$0.211 per egg, or \$12.03 for each breeder.

Table 144

	Cents
Feed	13.86
Depreciation	12.40
Labor	5.86
Miscellaneous	1.34
Interest	0.65
Total	34.11
Credits	1.23
Net cost	32.88

Cost of Incubating Turkey Eggs and Producing Poults

On 15 turkey farms in New York State, which produced poults in 1943, Misner[3] showed the net cost per 1000 eggs incubated was $276.08, or per 100 eggs, $27.60, or per egg, $0.276. Cost per poult was $0.528. When the value of the eggs was excluded from the figures, it cost $50.02 to incubate 1000 eggs, or $0.095 per poult.

Profit per Breeder Hen

The 8 *Illinois* turkey breeder flocks (1947) referred to previously, which averaged 603 laying hens, gave the results per flock shown in Table 145.[2]

Table 145

Total credits	$8724.94
Total debits	7095.62
Credits less debits	1629.32
Interest on investment at 5%	128.02
Profit	$1501.30
Profit per bird in 1947	$2.49
Profit per bird in 1945	6.45
Profit per bird in 1946	3.74

In *New York State*, 1943, the profit per turkey breeder averaged $3.78. Net cost per breeder was $8.25. Value of hatching eggs was $12.03.

Capital

Misner shows that a large amount of capital is required to run a turkey enterprise. There must be permanent investments in land, buildings, equipment, and stock on hand. Capital is needed for financing the

current expenses of feed, poults (purchased or produced), labor, and the like. In New York State, 1943, the total capital used amounted to $5.44 for each turkey raised. For each dollar of receipts $0.81 was invested.

This high capital investment calls for a high interest charge each year and good management if annual receipts are to equal the capital in 1 to 1½ years.

A study of 50 flocks of market turkeys in Virginia, 1948[5] showed a distribution of fixed capital prorated per farm of $922. Of this amount, buildings were valued at $549, heaters $122, other inside equipment $44, and range $207. For each 100 poults, this amounted to $48.

Cost of Producing Market Turkeys

The following costs of various items per bird raised and the percentages of total were found from a study in *Utah*, 1942. High costs were

Table 146. Expenses per Turkey Raised and Percentage of Total Cost, Utah, 1942[4]

	Per Bird Raised	
	Total Value	*Percentage of Total*
Mash	$1.29	32.8
Scratch grains	0.93	23.6
Miscellaneous feeds	0.03	0.9
Pasture	0.02	0.5
Total feeds	2.27 *	57.8
Poults	0.86	22.1
Man-hours	0.40	10.2
Equipment	0.17 †	4.2
Interest	0.12 ‡	3.1
Miscellaneous	0.02	0.6
Improvements	0.02	0.5
Taxes	0.01	0.3
Insurance	0.01	0.3
Medicines	0.01	0.3
Grit	0.01	0.2
Rent	0.01	0.2
Litter	0.01	0.2
Total	$3.92	100.0

* Exclusive of pasture.

† Includes costs for operating and depreciation of brooding equipment and trucks and auto, and other equipment.

‡ Includes interest on fixed capital at 5 per cent and also the amounts paid as interest for the use of operating money.

feed, poults, and man-hours. Feed was 57.8 per cent, poults at $0.64 each were 22.1 per cent, and man-hours at 1.35 hours per bird was 10.2 per cent of the total. Table 146 lists factors to consider in determining the cost of raising turkeys.

Costs during 1943 were high. On 32 New York State farms poults cost an average of $0.97, or 15.3 per cent of the total cost of raising the turkeys. Feed was the highest cost and labor the second. The net cost was $6.27 per bird. The average number reared per farm was 1840. The turkeys were marketed at 16.7 pounds live weight and dressed out 14.7 pounds.[3]

Economic conditions had changed by 1947, and the *Illinois* results[2] showed the net cost per bird to be $6.59 (Table 147).

Table 147

Net cost per pound of turkey produced	$0.35
Live weight of birds sold (pounds)	19
Net cost per bird	$6.59
Feed cost per bird	$4.73
Net sales value per bird	$7.94
Quantity of feed fed per 100 pounds produced (pounds)	568
Quantity of feed fed per 100 birds sold (pounds)	10,753
Percentage mortality in market stock	25.60
Fixed capital in plant per market bird	$0.87
Man-hours per 100 birds	80

Feed, poults, and labor were the three highest costs in producing market turkeys in 50 flocks in *Virginia*,[5] during 1948. Feed represented 72.7 per cent, poults 15.5 per cent, and labor 5.2 per cent. Fifty turkey market records were included in the survey. The average number of poults started was 1723. Mortality was 15.5 per cent. The live weight of toms, hens, and culls at sale was similar to those in the New York study in 1943, or 16.6 pounds, and they were sold at 25.5 weeks of age. Man-hours for each 100 poults started was 48.8, and the net cost per market turkey was $5.35.

Factors Affecting Profits in Producing Market Turkeys

Size of flock.
Age of poult.
Source of poults.
Mortality.
Labor efficiency.
Feed cost.
Weight per bird.

Grade per bird.
Price.
Experience of operator.

Size may be measured by the number of poults purchased or raised or by the number of pounds of meat produced (Table 148).

Table 148. Relation of Flock Size to Profit per Bird and Total Profit, Utah, 1942 [4]

Size of Flock Range	Average	Profit per Turkey	Total Profit
Smallest third	1586	$1.91	$3032
Middle third	2357	1.67	3947
Largest third	3868	1.84	7114
Average of all flocks	2661	1.81	4811

In Virginia, 1948, flocks of 2000 or more turkeys gave a higher return per man-hour, largely because fewer hours were needed per 100 poults

Fig. 106. Flock approaching market age.

started. The large flocks, however, had higher mortality, weighed slightly less, and were marketed somewhat sooner. Per pound sold,

feed cost was about the same, poult cost was higher because of heavier mortality, and net gain was lower.

Age of poult; Source of poult. Day-old poults have a better chance than older poults as they can start eating and drinking earlier in life. When shipped long distances requiring considerable time in transit, the poult is subject to a setback. Started poults are often handicapped, particularly if shipped some distance. Started poults are more frequently found in smaller flocks, have higher mortality, and develop into smaller birds; and fewer find their way into higher grades.

Day-old poults compared with started poults or with flocks made up of both returned a better profit.

Table 149. Receipts, Expenses, and Profit, Utah, 1942[4]

	Started Flocks	*Day-Old Flocks*
	Per Turkey Raised	
Net receipts	\$5.05	\$5.69
Total expenses	4.00	3.88
Profit	1.05	1.81
	Per Pound of Turkey	
Net receipts	\$0.325	\$0.330
Total expenses	0.258	0.225
Profit	0.067	0.105

Mortality should be kept low. Chances of keeping it so are better today than in 1942 when pullorum disease was more prevalent. Overcrowding in the brooder sometimes causes greater loss than occurs in uncrowded conditions on the range. Source of poults is important. Warm-weather brooding is likely to be a disadvantage.

In the Utah work, 1942, mortality was greater in large flocks.[4] The conclusions there were that too little room was available in the brooder and that the larger flock came under the care of hired labor more than the small flock. The mortality apparently came early in life, as the profit per bird was not greatly different.

Size	*Average*	*Percentage Mortality*	*Profit per Turkey*
Smallest third	1586	19.2	\$1.91
Middle third	2357	23.6	1.67
Largest third	3868	31.3	1.84

The Illinois records showed that mortality ranged from 9.6 per cent with a gross income per poult started of \$7.36, to 32.8 per cent with a gross income of \$4.69.

Mortality among the Virginia flocks was twice as high in the flocks of more than 2000 poults than in those under 1000.[5] In flocks of fewer than 1000 it was 9 per cent; 1000–1499, 11.6 per cent; 1500–1999, 14.6 per cent; and over 2000, 18.8 per cent.

The mortality rate is likely to be related to the feed cost and the cost of poults, as the cost of each for raising the bird to the point where death occurs must be divided among the remainder. Per pound sold, therefore, higher mortality raises costs and lowers the net gain and returns to labor.

The 1948 Virginia results[5] showed that, per pound of turkey sold, feed cost increased $0.012 and poult cost $0.016 as mortality increased from less than 8 per cent to 16 per cent or more.

Labor efficiency measured by man-hours per bird raised was best in larger flocks and averaged 1.4 for 68 flocks in Utah, 1942.

Larger flocks required less labor per 100 poults started in Virginia, 1948.[5] When flocks were separated into those having fewer than 35, and 65 or more man-hours per 100 poults started, it was found that the hours required were 21.5 and 80.8, respectively, and that the return to labor per hour was $10.06 and $3.32, respectively.

Feed cost is the highest cost and must be kept as low as is consistent with good nutrition and growth. There may be a point of diminishing returns and there probably is. *Illinois Bulletin A.E.* 2585 states the problem clearly:

> As turkeys increase in weight, more of the feed is used for maintenance and less is converted into flesh. When weight gains cease, all of the feed consumed is used for maintenance. Long before this point is reached, however, the amount of feed required to produce a pound of turkey becomes so great that it is not profitable to feed for additional gains. To finish a turkey properly requires an expenditure for feed that is not profitable when measured in terms of resulting gain. While a good finish is necessary, it should not be carried beyond the point *at which the turkeys will pick clean and carry a moderate covering of fat.*

Price may not always reflect efficiency of the feed. There are records (Utah, 1942) that show that the most expensive feeds produced birds which sold at lower prices than those raised on low-priced feeds. Feed cost may be increased by waste, but this may apply to all feeds. Turkey operators should consider carefully the item of feed cost.

Weight per bird; Grade per bird; Price. Heaviest birds are not always most profitable. Illinois in 1947 found that the birds "sold at 17 pounds live weight made a larger profit per unit of feed consumed than the heaviest birds made. For instance, 100 of the heaviest birds ate the

same quantity of feed as 132 of the lightest birds. The profit made by 100 of the heaviest birds was $161. With no more feed, 132 of the lightest birds, after paying for all expenses of production, made a profit of $203. All of the heaviest birds and 83 per cent of the lightest birds were broadbreasted bronze turkeys." See Table 150.

Table 150. Effect of Weight of Bird When Sold on Costs per Pound of Live Turkey, Illinois, 1947[2]

	One-Third that Sold Lightest Birds	*One-Third that Sold Heaviest Birds*
Live weight of birds sold (pounds)	17.0	21.0
Cost (cents)		
Feed	23.3	25.8
Poult cost per bird sold	4.4	3.5
Labor	1.9	2.6
Mortality	1.6	1.2
Miscellaneous	1.7	1.4
Total operating cost per pound	32.9	34.5
Interest on capital	0.6	0.4
Gross cost	33.5	34.9
Deductions from cost, manure, sacks	0.6	0.9
Net cost	32.9	34.0
Average selling price per pound	41.7	40.1

Weight may be associated with finish, percentage of toms, age marketed, and feed and price of feed consumed. In the Utah work, the smaller birds were fed less but higher priced feed. It is also noted that birds "weighing over 20 pounds brought a lower price per pound than smaller birds of the same sex and grade." Somewhere under 20 pounds, the prime birds brought a higher price per pound.

In Virginia, 1948, the highest net gain per pound sold occurred in the group averaging 15.6 pounds per bird at sale. Those averaging 18.2 and 20.2 pounds sold nearly as high. Weights below returned less. The lighter weight birds were in the largest flocks, and, although the labor charge was lower, the mortality was considerably higher. This raised the poult cost in cents per pound sold and reduced the net gain per pound sold. As pointed out earlier, the larger flocks at a lower labor

charge per 100 poults started gave a higher return per man-hour. When mortality is better controlled among larger flocks, they should have a still further advantage.

Experience of the operator. Experience is desirable for best results in many lines of work. Among 47 flocks in Utah, 1942, operators with most experience had larger flocks, less flock mortality in spite of larger flocks, more prime birds, and greater profit.

Effect of Efficiency Factors on Profit per Bird and per Operator

The factors selected for the Utah study (Table 151) were:

1. Number of birds raised.
2. Percentage of death loss in brooder.
3. Percentage of death loss on range.
4. Average weight per bird.
5. Percentage of birds in prime grade.
6. Cost per hundredweight of all feed.
7. Man-hours per bird.
8. Age of poults started.

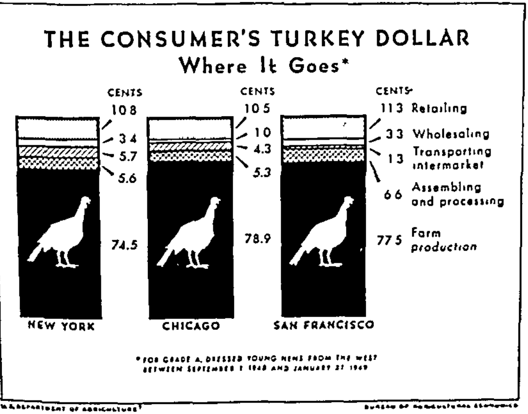

Fig. 107.

Table 151. Relation of Number of Factors Better than Average to Size of Flocks and Profits, 68 Turkey Enterprises, Utah, 1942[4]

Number of Factors Better than Average	*Number of Records*	*Average Number of Birds Raised*	*Average Profit per Bird*	*Average Profit per Operator*
0	1	1508	\$1.25	\$1889
1	6	2191	0.61	1347
2	6	2399	0.92	2216
3	13	2715	1.13	3069
4	8	2269	1.44	3262
5	12	2592	1.78	4614
6	15	3243	2.20	7118
7	6	3698	2.34	8657
8	1	3061	2.60	7964
Total or average	68	2757	\$1.66	\$4578

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21 · The Duck Industry

Ducks grown in the United States increased 801,333 between 1929 and 1939 (Table 152). All regions dropped except the Middle Atlantic and Pacific, which showed increases of 3,782,910 and 160,156 respectively. In the Middle Atlantic region New York State and New Jersey gained, whereas Pennsylvania decreased in number of ducks raised by 202,479.

The number of ducks grown in New York State increased 3,822,516 in the 10 years 1929–1939. The gain in New Jersey was 162,873.

Reference to Fig. 108 for 1939 shows the duck enterprise to be centered largely in the northeastern quarter of the United States and in California.

Table 152. Number of Ducks Raised in 1939 and 1929, and Value in 1939, by Regions

	1939		
Region	*Number*	*Value*	*1929*
New England	560,590	$ 506,702	591,149
Middle Atlantic	6,521,761	5,923,571	2,738,851
East North Central	2,152,814	1,623,961	3,011,061
West North Central	1,463,977	881,570	3,166,201
South Atlantic	398,953	271,216	590,989
East South Central	92,421	42,758	217,688
West South Central	186,351	85,937	332,412
Mountain	97,224	71,903	181,230
Pacific	664,729	512,810	504,573
United States	12,138,820	$9,920,431	11,337,487

Duck production is seasonal, receipts on the New York market being greatest in June and July. Production increases are most rapid during March and April.* Long Island is the largest duck-producing area in the United States, and 95 per cent of the dressed ducks received at New York City are produced there.

* For much of the material pertaining to production costs, prices, receipts, storage, and consumption in the duck industry, the writer is indebted to A. Neil McLeod and his excellent thesis entitled, "Production and Marketing of Long Island Ducks," presented to the Faculty of the Graduate School of Cornell for the degree Doctor of Philosophy, 1950.

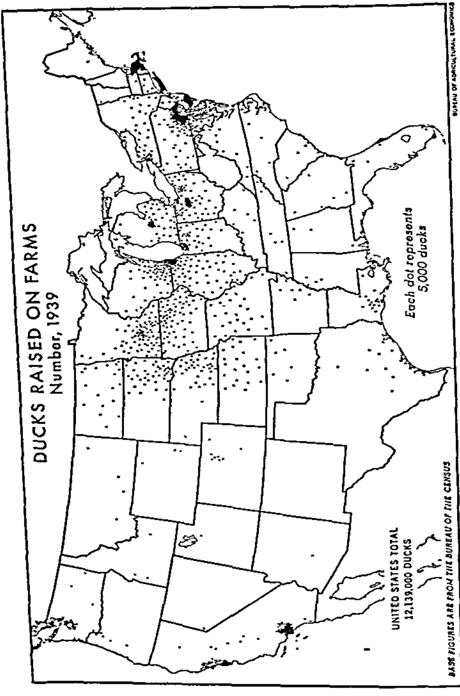
DUCKS RAISED ON FARMS
Number, 1939
Each dot represents
5,000 ducks
UNITED STATES TOTAL
12,139,000 DUCKS
BASE FIGURES ARE FROM THE BUREAU OF THE CENSUS
U S DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

Fig. 103.

In 1948 a survey of 37 duck farms in Suffolk County, Long Island, New York, was made on the basis of large, medium, and small operations. Since each farm is a complete unit, carrying its own flock of breeders, the number of breeders is a measure of size of business. The largest farms, 32 per cent of the total number, produced 54 per cent of the ducks (Table 153).

Table 153

Breeders		Farms		Ducks Produced	
Range	*Average (Number)*	*Total (Number)*	*Proportion of Total (Per cent)*	*Total (Number)*	*Proportion of Total (Per cent)*
350– 700	554	11	30	298,310	14
701–1200	962	14	38	706,620	32
1201–2800	1879	12	32	1,162,890	54
Total or average	1138	37	100	2,167,820	100

Ducklings are grown on fresh-water streams and sandy beaches which slope to the water's edge. The type of soil has had much to do with the

Fig. 109. A typical Long Island scene in the duck areas.

success of the enterprise. Thousands of ducklings line these beaches, the various ages being separated from each other by low fences. At 9–11 weeks they are ready to be killed, picked, packed, and marketed.

The acreage used is not large. The average was 11.9 acres per farm. Twenty farms, or 54 per cent of all the farms, averaged 6.8 acres. Fourteen farms, or 38 per cent, averaged 15.8 acres, and 3 farms, or 8 per cent, averaged 27.7 acres. There was none over 50 acres.

Production on Long Island farms has varied from a few thousand ducklings to 500,000 per farm. Among the 37 surveyed the number of

ducklings produced varied from 7780 to 156,480 per farm. The average was 58,590.

The number of ducklings grown per acre is large; however, more than one lot may be grown on the same land in a season. On 37 Long Island, New York, farms of 11.9 average acreage, 4882 ducklings were produced per acre (farms of 6.8 acres produced 6399; farms of 15.8 acres produced 3972; and farms of 27.7 acres produced 4551).

Capital

The amount of capital to operate a business of sufficient size to make a comfortable labor income is large. On 37 Long Island duck farms the average amount was $77,367 for 11.9 acres producing 58,590 ducklings. The dwelling is not included in the total investment (Table 154).

Table 154

	Amount per Farm	*Percentage of Total*
Land	$ 8,783	11
Buildings	42,079	55
Equipment	15,375	20
Ducks	11,130	14
Total	$77,367	100

Costs and Returns

Duck farmers deal in large figures and the risk is, therefore, considerable. Note in Table 155 the total expenses and receipts required to return a labor income averaging $4016 on the 37 farms.

Fig 110 The feed-car track. Pellets or mash is fed into boxes or feeders from the car.

Returns from duck feathers is and has been an important income factor. In 1948 it amounted to an average of $5702 per farm.

Table 155. Costs and Returns, 37 Duck Farms, Long Island, New York, 1948

	Amount per Farm	*Total per Farm*
Costs		
Net depreciation of breeders	$410	$ 410
Labor (man equivalent)	6.6	11,733
Feed	909 tons	87,218
Buildings		5,218
Land		843
Equipment		2,400
Truck, tractor, and auto		1,122
Miscellaneous		10,714
Interest on duck inventory		557
Total costs		$120,215
Returns		
Eggs sold	1,114 doz.	$ 582
Baby ducklings sold	736	172
Ducks sold, dressed	274,225 lb	97,519
Ducks sold, alive	43,355 lb	14,254
Ducks sold, retail, eaten, and gifts	5,489 lb.	2,521
Ducks on hand	1,101	1,128
Ducks transferred to breeder flock	760	2,146
Feathers and other returns		5,879
Total		$124,231
Labor income		4,016
Return per man-hour		1.07

Cost of Producing Hatching Eggs

Feed for breeders is the greatest single expense. It is more than 80 per cent of the total cost of producing hatching eggs. It is nearly as much as the returns from eggs, feathers, and miscellaneous items. The breeder enterprise alone operated at a loss; that is, for each man-hour a loss of $6.77 was experienced. Since breeding is a part of the duck-growing work, this loss is absorbed as a cost when one considers the entire enterprise.

The cost per dozen of hatching eggs was $1.86 on the Long Island farms.

Size of the breeding flock did not affect the cost per dozen.

Production per female is an important factor. It ranged from 56 to 147 eggs per bird.

Flocks averaging 130 eggs reduced the cost to $1.57 per dozen hatching eggs. Those averaging 101 eggs raised the cost of producing hatching eggs to $2.01.

Labor Efficiency

Efficient farms spent an average of 9 hours per breeder, whereas 13 hours was required on other farms. On 7 farms 1 man cared for more than 270 breeders, whereas on 10 farms the number was lower. The cost per dozen hatching eggs was $1.59 and $1.78, respectively.

Cost of Producing Ducklings

This is one of the most profitable parts of the business. The cost per duckling was $0.22, and the return per man-hour was $6.38. Also, this enterprise gave an average labor income of $4200.

The number of eggs set had little influence on the cost, but man-hours was important. Those farms requiring under 12 hours per 1000 eggs set produced ducklings for $0.192, and those over 12 hours, $0.237.

Hatchability was likewise important. The average was 68 per cent. Those above averaged 75 per cent and those below 61 per cent. The cost of ducklings was, respectively, $0.194 and $0.240.

Cost of Raising Market Ducks per Pound

The average cost was $0.36. The labor income on this phase of the enterprise was $2972, and the return per man-hour was $1.28.

There appeared to be little relation between the *number of ducklings produced* and net cost per pound. *Man-hours* on the larger farms was slightly lower, but the wage rate was higher. However, those farms having more than 14,000 ducks per man lowered the cost per pound $0.017.

Feed cost per duck was the same on large and small enterprises, but less per pound on farms producing larger ducks.

The *value of dressed sales* on larger farms was higher but retail sales were lower than on smaller farms. Farms with *ducks weighing more than 5.6 pounds* reduced the cost per pound more than $0.025.

Mortality was costly. Costs per pound of duckling were $0.376 on farms averaging 16 per cent mortality and $0.34 for those averaging 5 per cent mortality.

When 16 farms were divided into 2 lots, above or below 11 per cent mortality, the cost of feed per pound of duck was $0.242 and $0.205, respectively.

Duck Receipts, Storage, Prices, and Consumption

Receipts at New York are lowest in January, February, March, November, and December. From May to August, inclusive, the index of receipts is more than twice as high as during the low-receipt months, with June and July the highest of the year. Figure 111 substantiates

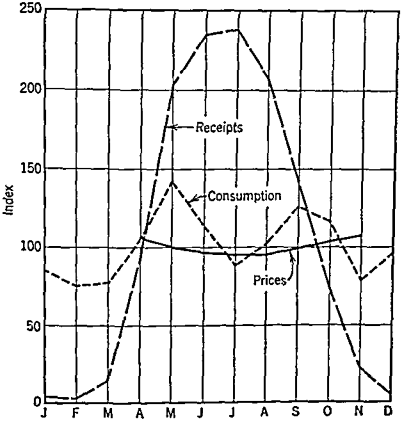

Fig. 111. Index of seasonal variation of New York-dressed Long Island duck receipts and prices at New York City, 1932–1948, and of United States consumption for the same period. Although less sharply and with greater variation, consumption *of ducks appears tied to fresh receipts.* Price *varies only slightly,* and, as with consumption, is lowest when receipts are highest. (*Source: figures from thesis by McLeod.*)

the statement previously made that receipts of ducks are decidedly seasonal.

Storage. From 1932 to 1948 the average storage holdings of ducks in the United States increased from April to October. The most rapid movement into storage has been from June to August, and the highest holdings in September, October, and November. McLeod points out that when production and market receipts increase beyond 16 million pounds the fresh market is unable to absorb its share and the storage load is increased.

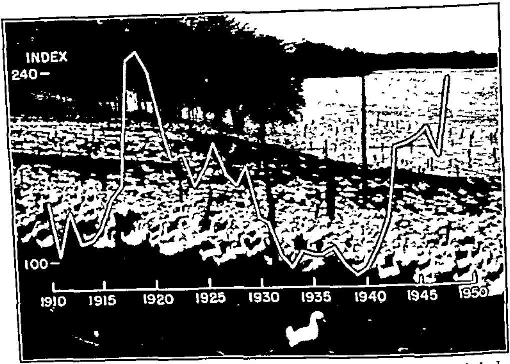

Fig. 112. Index of weighted annual price per pound, Long Island-dressed ducks, New York City, 1910–1948 (1935–1939 = 100).

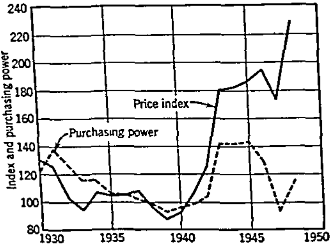

Fig. 113. Index of weighted annual Long Island duck prices per pound, New York-dressed, New York City, and purchasing power of ducks in terms of the all-commodity index, 1930–1948 (1935–1939 = 100). The duck price index has improved since 1940, and the purchasing power was generally favorable until 1946 (*Source: figures from thesis by McLeod.*)

*Consumption.** The index of consumption from 1932 to 1948 shows a fairly constant trend annually, with a suggestion of highest demand while fresh receipts are highest, April to September, inclusive. The lowest annual consumption is in February.

Price. The seasonal variation in price shows a slight change during the year. Figure 111 illustrates this variance from April to November. The highest index is 106 and the lowest 95.

The index of the price per pound from 1910 to 1948, Fig. 112, shows that high comparative prices prevailed from 1918 to 1921, after which the decline continued until the low points were reached in 1933 and 1939. In 1940 the index started up and has been steadily improving since, with the exception of 1947.

The purchasing power of ducks has been favorable except for the years 1938–1941, and 1947. In 1946 and 1947 it dropped, but started upward in 1948. Both the general price level and the index for the price of ducks were higher in 1948, thus resulting in a fair purchasing power.

The price of a commodity must be related to the price of other things in order to determine actual financial benefits.

* Calculated by monthly receipts of ducks, less monthly additions to United States storage stocks; or monthly receipts of ducks, plus monthly decreases in United States storage stocks, as a measure of monthly consumption.

22 · The Squab Industry

In 1939 California was the leading squab-growing state in the country, with New Jersey, Pennsylvania, and South Carolina following in that order. New York, Georgia, Florida, and Texas each produced more than 25,000 (Table 156).

Table 156. Number and Value of Pigeons Raised, by Regions, 1939 [1, *]

Region	*Number Raised*	*Value*
New England	25,390	$ 6,278
Middle Atlantic	382,074	90,965
East North Central	26,163	3,421
West North Central	32,273	4,040
South Atlantic	183,156	48,268
East South Central	7,365	1,524
West South Central	51,655	9,163
Mountain	11,155	2,489
Pacific	593,115	148,804
United States	1,312,346	$314,952

* Later figures unavailable.

Pigeons are kept for squab production in various sized flocks and under many conditions. They vary greatly in value, as illustrated in

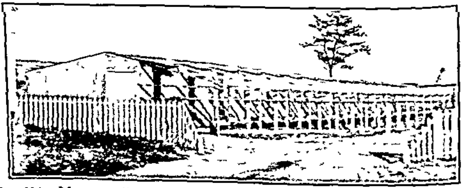

Fig. 114 Many small and a few large plants provide the commercial squabs in our markets.

Table 156. Over the United States as a whole the value per pigeon raised was about $0.24 in 1939. Squab produced in commercial flocks often weigh 1 pound or more dressed. The annual average price per pound from 1936 to 1944, inclusive, varied from $0.33 in 1936 to $0.86 in 1944 and averaged $0.48 for the 9 years, at the New Jersey Agricultural Experiment Station.[2]

A complete and thorough economic study of squab production has never been undertaken, says Professor Platt. From the New Jersey

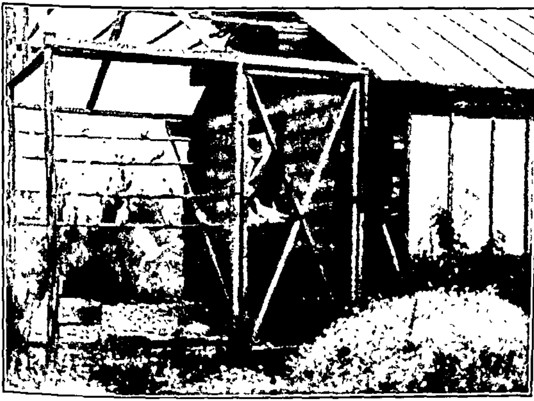

Fig. 115. A White King breeding pen in Alaska. (*Courtesy Harold E Botsford, Jr.*)

State Pigeon Breeding Test, Millville, New Jersey, figures have been released which indicate that factors influencing returns from commercial squab production are similar to those affecting other types of poultry.

Squabs per Pair of Breeders

Rate of production. Breeders vary from 13.5 to 4.4 squabs per pair per year. This factor assumes importance in the selection of breeding stock, since 6 to 7 months must pass before the young breeders mate and start production. "The amount of feed consumed from 6 weeks to 8 months is about 21.2 pounds per bird."[3] Squabs for future breeders are selected from parents whose offspring show high livability, even

development of each pair of squabs, and prolificacy. At the age of 6 weeks or thereabouts the squabs are removed to a separate pen where, with others, they remain until mates are selected and eggs are laid, when they are removed to regular production pens.

Sex is best determined when the pairs start nesting or later, since male and female take turns in brooding the eggs and at rather definite periods during each 24 hours.[3,4,5]

Allowing for possible mortality and sufficient number of both sexes, more squabs than those actually needed are usually reared. Platt states that 220 squabs should be reared for each 100 mated pairs desired; 4664 pounds of feed, or 46.64 pounds for each final mated pair, is required. Replacement costs are, therefore, high.

First-year production at the New Jersey Test showed the largest number of pairs of breeders giving 9 to 12 squabs annually. The next highest group gave 13 to 14 squabs. Twenty-four pairs produced 1 to 2 squabs and 8 pairs 17 to 18 squabs (Table 157).

Table 157. Distribution of Pairs of Pigeons according to Annual Squab Production during Their First Year[2]

Squabs Annually	*Number*	*Percentage*
1–2	24	4.81
3–4	36	7.21
5–6	44	8.82
7–8	57	11.42
9–10	107	21.45
11–12	106	21.24
13–14	76	15.23
15–16	41	8.22
17–18	8	1.60
Total	499	100.00

Breeders are kept for several years. In the second and third years they are likely to be most prolific. The writer has records on file of a pen of 50 pairs, 12 years old, that produced 416 squabs, or 8.3 squabs per pair of breeders.

Table 158 shows the number of squabs per year produced by breeders in each of 5 years, and the total for the 5 years.

Production by Breeds

At the New Jersey Test the Mondaine produced the heaviest squabs, but was less prolific. The Carneaux was most prolific but had the lightest squabs. White Kings were consistently high in both respects for the two periods 1931–1935 and 1936–1944[2] (Table 159).

Table 158. Annual Squab Production of Each Pair of Pigeons Kept for 5 Years[2] *(60 Months)*

Number	*First Year*	*Second Year*	*Third Year*	*Fourth Year*	*Fifth Year*	*Total Squabs*
1	6	15	16	12	12	61
2	8	11	11	8	1	39
3	8	18	11	9	11	57
4	9	11	11	12	4	47
5	12	16	16	7	2	53
6	12	15	17	18	10	72
7	12	15	16	9	6	58
8	12	18	14	15	12	71
9	13	14	17	14	7	65
10	13	16	17	16	8	70
11	14	15	15	14	11	69
12	14	16	16	7	5	58
13	14	18	13	17	12	74
14	14	12	8	7	0	41
15	14	14	17	13	7	65
16	15	15	17	10	3	60
17	15	7	12	10	12	56
18	15	14	13	13	5	60
19	15	15	13	11	13	67
20	16	13	16	11	7	63
21	17	13	12	10	6	58
Total	268	301	298	243	154	1264
Average	12.8	14.3	14.2	11.6	7.3	60.2

Table 159

1931–1935

Breed	*Pairs of Pigeons*	*Squabs per Pair of Pigeons*	*Average Dressed Weight per Squab (Ounces)*	*Pairs Broken by Mortality (Per Cent)*
White King	189	11.1	16.8	3.8
Giant Homer	105	11.4	15.7	1.9
Mondaine	66	9.5	17.5	3.1
Carneaux	82	13.0	15.6	0
Silver King	103	10.8	17.1	3.8
		1936–1944		
White King	264	10.2	16.8	0.4
Giant Homer	208	9.5	16.7	1.0
Mondaine	96	8.8	18 1	4.2
Carneaux	66	10.9	16.3	1.5
Silver King	42	9.1	18.1	2 4

Weight of squabs during the first year of production is likely to be about the same as that in later years. Platt[2] has calculated the dressed weight at 86.4 per cent of live weight, and his figures for 354 pairs of pigeons are shown in Table 160.

Table 160

Number of Pairs of Pigeons	Average Dressed Weight of Squabs Produced (Ounces) First Year	Second Year	Third Year	Fourth Year	Fifth Year
201	16.8	16.8	—	—	—
100	16.7	16.8	16.4	—	—
32	16.8	17.0	16.8	16.7	—
21	16.9	17.2	16.9	16.9	16.9

A striking similarity in the average live weight per squab prevailed at the New Jersey State Pigeon Breeding Test from 1931 to 1944. Records were kept on 1810 pairs of pigeons over that period. The average weight per squab was 19.3 ounces. The lowest average weight was 18.8 ounces in 1931 and 1932. The highest was 19.9 ounces in 1934.

The *law of diminishing returns* appears to operate with pigeons. White King squabs weighing 19.0–19.9 ounces each gave the highest return over feed. As squab weight increased the number of squabs decreased and, of course, returns were less (Table 161).

Table 161. Relationship between Weight of Squabs and Economy of Squab Production in the White King Breed[2]

Average Weight of Squabs (Ounces)	Annual Squab Production per Pair of Pigeons	Returns over Feed Cost per Pair of Pigeons	Number of Pairs of Pigeons
17.0–17.9	10.9	$2.60	30
18.0–18.9	10.9	2.55	66
19.0–19.9	11.6	2.79	72
20.0–20.9	11.7	2.72	48
21.0–21.9	9.8	1.93	30
22.0–22.9	4.9	−0.02	18

Investment

Recent figures are scarce. A record taken April 7, 1917,* for the year December 1, 1915–December 1, 1916 on a New York State pigeon

* H. E. Botsford, unpublished data, Cornell University.

operation averaging 1466 pairs of breeders showed the investment given in Table 162.

Table 162

	December 1, 1915	*November 30, 1916*
Real estate	$2366.00	$4556.00
Machinery and tools	400.00	420.00
Livestock	2123.00	3308.00
Supplies	200.00	200.00
Cash on hand to operate	500.00	500.00
Total	$5589.00	$8984.00
Average investment	7287.00	
Average investment per pair	4.97	

Prices have advanced greatly since 1916, and current investment would probably be greater than that shown. Silver King and White Carneaux breeders were priced from $8 to $20 per pair in 1950.[6]

Tested pairs that have bred 4 years:	$ 8.00 pair
Tested pairs that have bred 3 years:	12.00 pair
Tested pairs that have bred 2 years:	16.00 pair
Tested pairs that have bred 1 year:	20.00 pair

A production of 14 squabs a year is considered satisfactory in South Carolina.[6] An average valuation of prime breeding stock in 1950 might approach $10–$12 per pair.

Housing costs have advanced. A pen for 32 pairs could be built in 1923 for $70, fully equipped. In 1950 the cost was nearer $140–$150. Feed and labor, as well as the selling price per pound, has increased over the figures shown for 1915–1916 and the New Jersey figures for 1936–1944. The dressed weight of squabs and feed consumed were much the same in 1950.

Costs and returns on one average pair of breeding pigeons are quite similar to those for one laying chicken. Space required is nearly the same.

The balance of the labor-income record taken in 1917 is shown in Table 163.

Table 163. Record on a Pigeon Breeding Plant *

Location: Hartsdale, New York.
Production: Old birds—8-10 squabs per year.
In prime—11-15 squabs per year.
Breeders kept 8 to 10 years.
Total annual squab production: 10,476 pairs.
Number of men hired throughout the year: 2.

Expenses	
Labor paid	$1000.00
Supervisor's labor †	300.00
Machinery, new	20.00
Buildings, new	1900.00
Building repairs	300.00
Feed	2200.00
Straw and tobacco stems	37.22
Shipping boxes	2.00
Fuel and oil	5.00
Disinfectant	5.00
Express	25.00
Ice	16.25
Insurance	16.97
Taxes	58.07
Leg bands	10.00
Stock purchased	25.50
Interest @ 5%	364.35
Total	$6285.36
Returns	
Squabs, 10,476 pairs	$3390.69
Manure	225.00
Feathers	20.00
Labor away from plant	10.00
Stock sold	145.16
Increase in inventory	3395.20
Total	$7186.01
Summary	
Average capital	$7287.00
Receipts	7186.01
Expenses	6285.35
Net gain	$ 900.66

* H E Botsford, unpublished Cornell data. Writer was manager of this plant in 1910–1911 and took the record April 7, 1917.

† General Manager's salary pro-rated against this enterprise as part of a large farm.

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6. Palmetto Pigeon Plant, Sumter, S. C. (*courtesy Harold Moise, Mgr.*)

23 · The Goose and Guinea Industries

THE GOOSE INDUSTRY

Between 1929 and 1939 geese decreased in the United States, a drop of 2,837,532 occurring in the number raised. Every region in the United States raised fewer geese at the end of the 10-year period (Table 164).

Table 164. Number of Geese Raised in 1939 and 1929 and Value in 1939 by Regions in the United States[1]

Region	Number 1939	Value 1939	Number 1929
New England	6,350	$ 13,734	26,950
Middle Atlantic	69,206	136,399	197,870
East North Central	307,988	437,574	1,175,603
West North Central	567,602	670,955	1,550,136
South Atlantic	34,547	46,385	200,228
East South Central	30,996	25,495	252,511
West South Central	82,552	67,018	397,245
Mountain	26,139	43,095	93,243
Pacific	26,919	46,224	96,045
United States	1,152,299	$1,486,879	3,989,831

All states showed a decrease except New Jersey and New Mexico, which gained 11,177 and 115, respectively.

Geese consume large quantities of roughage as greens, dry stalks, hay, and vegetables. Since geese utilize considerable pasture, taxes and interest on the land pastured are included in the figures that follow.

An average number per acre is 20–25 heavy geese. As the Peytons[2] point out, acreage capacity varies, depending on the type of soil, the nature of the crop, and the weather.

Feed required was 124 pounds to keep a goose for 1 year and 27 pounds, not including roughage, to raise a gosling for market.[2]

Feed is the highest cost. Labor is the next highest individual item. The cost of keeping a breeder Toulouse goose for one year in 1947 is shown in Table 165[2]

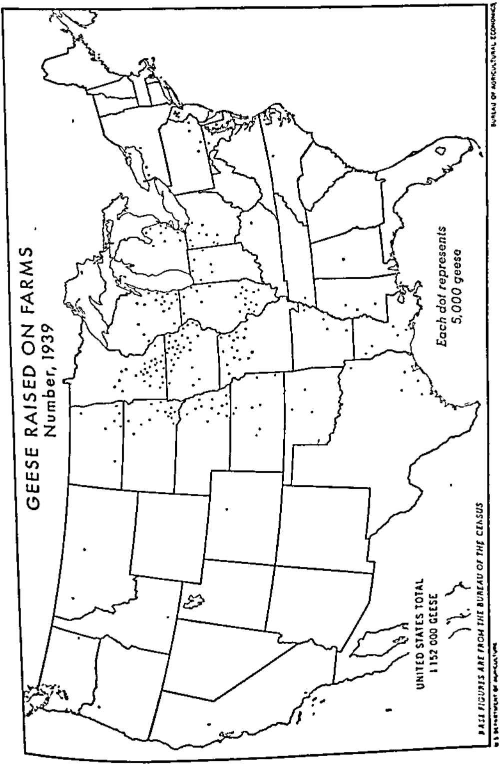
GEESE RAISED ON FARMS
Number, 1939
Each dot represents 5,000 geese
UNITED STATES TOTAL
1 152 000 GEESE
BASE FIGURES ARE FROM THE BUREAU OF THE CENSUS
U S DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

Fig. 116.

Table 165

Feed	
72.4 lb. grain @ \$0.026	\$1.88
18.5 lb. mash @ \$0 030	0.56
15.0 lb. clover and timothy hay @ \$20 per ton	0.15
18.0 lb. cull vegetables	0.09
123.9 lb.	
Total feed	\$2.68
Labor per hour *	0.50
Mortality (cost per bird)	0.08
Miscellaneous (depreciation, building and equipment, maintenance, insurance, taxes, interest on investment at 5%)	0.56
Cost to keep a breeder goose	\$3.82

* Time for special work with breeders not included.

Table 166. Cost of Producing Toulouse Hatching Eggs [1]

Cost of keeping 1 goose	\$3.82
Cost of keeping the gander *	1.27
Cost per female and ⅓ male	\$5.09
Cost to produce one hatching egg †	\$0.22

* One-third of the cost of keeping a goose: 1 gander for 3 geese.
† 23 eggs per female.

Table 167. Cost of Producing Day-Old Goslings [1]

Cost for eggs per gosling hatched	\$0.55
\$0.22 per egg = \$22 per 100 eggs	
40% hatch = 40 goslings per 100 eggs	
\$22 ÷ 40 = \$0 55	
Other costs: electricity, labor, depreciation, maintenance, insurance, taxes	0.04
Cost of producing a gosling	\$0.59

Table 168. Cost of Raising a Goose to Market Age [1,*]

Feed	
First 4 weeks	
Started in batteries; moved to range brooder houses at 2 weeks, much grass consumed; mash at all times; 4 2 lb. mash per gosling @ \$0 03	\$0.13
Next 20 weeks	
16.1 lb. grain @ \$0 026	0.42
Last 2 weeks	
6.9 lb grain per bird, free choice of corn, oats, and wheat, birds given run in standing corn stalks from which corn had been removed	0.18
Total feed cost to 26 weeks	\$0.73

Labor	
0.126 hour per bird, based on 73.5 hours for 584 geese @ $0.50 per hour	$0.06
Mortality	
4% loss, nearly all during first 4 weeks	0.03
Miscellaneous (brooding fuel, depreciation, and maintenance on buildings and equipment, insurance, taxes, and interest @ 5%)	0.16
Total operating costs	$0.98
Cost of the gosling	$0.59
Cost of raising a goose 26 weeks	$1.57
Average weight per goose	14.8 lb.
Average cost of meat production	$0.105 per lb.

* This cost was based on 584 Toulouse goslings from time hatched to time marketed, or 26 weeks, males and females included.

THE GUINEA INDUSTRY

The number of guineas raised in the United States in 1939 was 948,755, and the value $324,524.

Distribution over the United States showed the West North Central states, Minnesota to Kansas, having the largest number, and the West South Central states, Arkansas to Texas, second (Table 169).

Table 169. Number of Guineas Raised, by Regions, 1939[1]

Region	*Number*
New England	2,586
Middle Atlantic	52,120
East North Central	110.742
West North Central	310.191
South Atlantic	171.420
East South Central	102.579
West South Central	181.093
Mountain	9,853
Pacific	8,171
United States	948,755

Missouri was the largest guinea-growing state in 1939, with 157,309 birds valued at $42,865. Oklahoma was second with 76,339 birds valued at $19,799. Third was Illinois with 64,014 birds valued at $21,730.

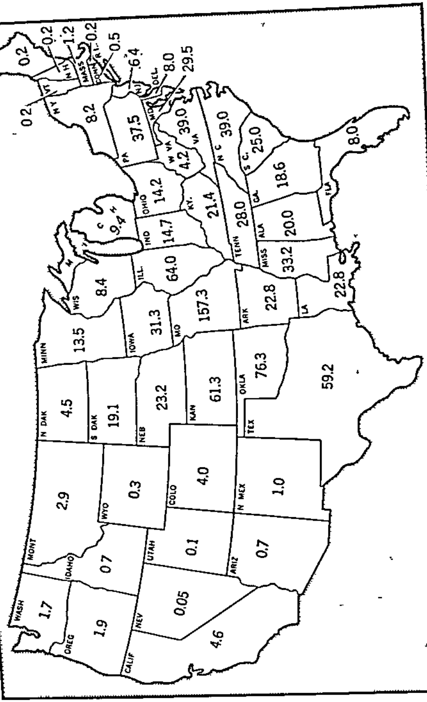

Fig. 117. Number of guineas raised in the United States, by states, in thousands, 1930. Total raised, 918,755. Value, $321,521.

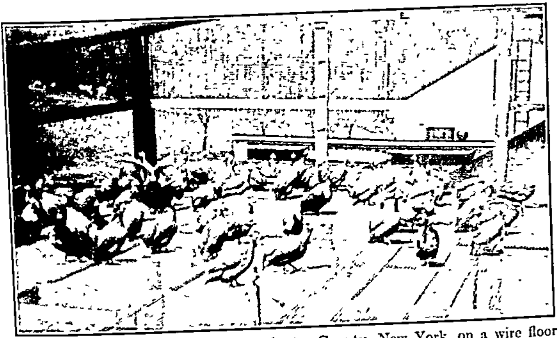

Fig. 118. A flock of guineas in Westchester County, New York, on a wire floor outside pen.

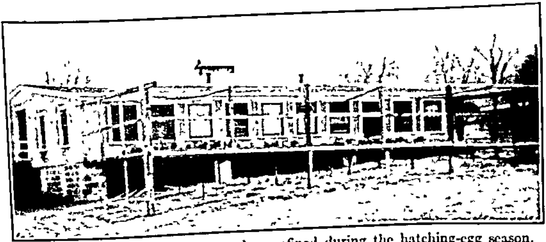

Fig. 119. Guinea breeders may be confined during the hatching-egg season.

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24 · Farm Costs and Prices in Marketing Poultry and Eggs

Market poultry is largely sold from the farm alive.

Farm dressing plants are increasing in localities insuring desirable local markets.

"More small local poultry dressing plants are recommended as a method of making dressed poultry more readily available in the producing areas and in and around towns and cities." [1]

Commercial dressing plants are found where the volume of live poultry is large.

Nearly half the dressed chickens sold from farms in New York State are drawn.

For 184 farms in New York State averaging 4938 chickens annually, the investment in buildings, processing, and selling equipment was $832.13 per farm.

Labor accounts for 60 per cent of the total operating costs in dressing chickens on New York home dressing plants.

The profit per pound, live weight, for all chickens dressed in home dressing plants in New York was $0.029 and the return per man-hour was $1.134.

New York-dressed chickens gave higher returns per man-hour of labor than drawn chickens.

The markup above the live price of chickens should cover extra costs, dressing loss, and profit.

Nearness to market and better net prices go together.

Poultry

In 1940–1941 a study on 120 commercial poultry farms in New York State [2] showed that 92 per cent of the Leghorn layers and 83.4 per cent of the heavy breeds were sold alive at the farm; 8.8 per cent of the heavy breed layers and 2.4 per cent of the light breeds were sold dressed.

In New York State the live price, when chickens are sold to dealers at the farm, is often based on the live wholesale price at New York City. A differential of $0.03 to $0.04 under New York City price at the farm is about equivalent to the net return if shipped. The differential covers shrinkage, transportation charges, and selling charges.

Outlets for Killed Chickens

There are very few commercial dressing plants but a large number of home dressing plants in New York State. A small percentage of the

birds is used at home; Searls * found 1.7 per cent so used. New York-dressed † birds comprised 52.5 per cent of those sold, whereas 45.8 per cent were sold dressed and drawn. The chickens were sold to consumers, institutions, and stores, the number to each varying according to region of the state. The western and upper Hudson Valley sold larger percentages of New York-dressed chickens to stores, but direct-to-consumer sales exceeded others in the central and lower Hudson Valley sections. See Table 170.

Table 170. Variation between Areas in Percentage of New York-Dressed and Drawn Chickens Sold to Different Outlets, 184 New York Farms, 1946–1947 [a]

	Percentage Distribution of All Processed				
	Western	*Central*	*Upper Hudson*	*Lower Hudson*	*All Areas*
New York-dressed					
Consumers	3.9	25.4	7.3	35.1	17 3
Institutions	10.0	8.8	17.6	21.5	13.7
Stores	20.4	10.9	32.6	26.9	21 5
Total	34.3	45.1	57.5	83 5	52 5
Drawn					
Consumers	12.5	8.5	34.2	8.7	13.9
Institutions	49.9	42.6	5.5	5.9	30 6
Stores	1.9	2.2	0.5	—	1 3
Total	64.3	53.3	40.2	14 6	45.8
Eaten	1.4	1.5	2.3	1.9	1.7
Spoiled	—	0.1	—	—	[a]
Total processed	100.0	100.0	100.0	100.0	100 0

[a] Less than 0.05.

Institutions took most of the drawn birds in the western and central sections of the state. One-third went to consumers in the upper Hudson Valley.

Investment in Home Dressing Plants

The average number of chickens processed on 184 farms was 1938. The investment in buildings averaged $411, processing and selling equipment $199.81 and $221.29, respectively (Table 171).

* The tables and discussion on dressed poultry that follows are largely taken from a study by Elmer N. Searls on "Costs and Returns in Marketing Dressed Chickens," Cornell University Department of Agricultural Economics, *A.E.* 681, October 1948.

† Bled and feathers off.

Table 171. Investment in Processing and Selling Equipment, 184 Farms, New York State, 1946–1947 [a]

	Average per Farm	Distribution (Per Cent)
Processing		
Coops	$ 12.70	3.0
Killing funnels	1.87	0.5
Tank for blood	2.47	0.6
Scalder	43.66	10.4
Picker	118.10	28.0
Tables	3.02	0.7
Singer	0.47	0.1
Washing	4.00	1.0
Other	13.55	3.2
Total	$199.84	47.5
Selling		
Cooler	$192.91	45.8
Scales	20.48	4.8
Other	7.90	1.9
Total	$221.29	52.5
Total processing and selling	$421.13	100.0

Costs and Profit in Farm-Dressed Chickens

Labor is the highest cost, averaging $0.041 per pound of live chicken dressed. The total cost per pound of chicken averaging 3.6 pounds alive on these farms was $0.428. The total returns were $0.457, leaving a profit of $0.029 per pound above the value of the live bird per pound. As the value of the live chicken per pound was given as $0.36, the returns per pound of chicken was $0.389 (Table 172).

Processing consumed 1108 hours for 4938 chickens, or 17,721 pounds. The returns per man-hour were $1.134. See Table 172.

Table 172. Costs, Returns, and Profits in Cents per Pound of Live Chicken Dressed, Average of All Chickens on 184 New York Farms, 1946–1947 [a]

Number of chickens dressed	4,938
Live weight of chickens	17,721
Live weight per chicken	3.6
Hours of dressing and selling	1,108
Number of chickens processed per hour	4.5
Live weight processed per hour	16.2

Costs	
Building	0.3
Equipment	0.5
Labor	4.1
Truck and auto	0.9
Tractor and horse	*
Fuel and electricity	0.2
Ice	0.1
Telephone and office	0.2
Advertising	0.1
Packaging materials	0.2
Other	0.2
Total operating costs	6.8
Live chickens	36.0
Total costs	42.8
Returns	
Custom work	0.3
Offal	*
Eaten	0.8
Total other than sales	1.1
Sales	
New York-dressed	23.5
Drawn	21.1
Total sales	44.6
Total returns	45.7
Profit per pound	2.9
Returns per man-hour	113.4
Returns per pound of chicken	38.9

* Less than 0.05.

Factors Affecting Costs and Returns in Marketing Dressed Chickens

Four factors were found important:

Number of chickens processed.
Style of dressing.
Efficiency of operation.
Percentage markup in price per pound.

Number Processed

The larger business was more efficient (Table 173).

Table 173

	Number of Chickens Processed				
	Under 1000	1000–2499	2500–3999	4000–9999	Over 9999
Number of farms	40	51	34	34	25
Number of chickens	576	1,644	3,178	6,332	19,131
Live weight of chickens (pounds)	2,981	8,079	13,388	23,698	58,739
Profit per pound	−2.4	2.8	2.2	3.8	3.0
Return per pound of live chicken	31.6	38.3	39.2	39.5	39.3
Return per man-hour	46.8	97.6	94.4	121.6	130.8

Style of Dressing

More time is required for drawing than for New York-dressing. The average number of birds processed New York-dressed per hour was 5.4, and the number drawn averaged 3.9 per hour. The labor cost for drawn birds is, therefore, higher.

"Profits on farms selling New York-dressed chickens averaged 2.7 cents per pound and varied from 0.7 cent for the half with fewest chickens to 3.0 cents per pound for those with most chickens. The profits on farms selling drawn chickens were 1.8 cents per pound with the small volume group losing 1.1 cents and the large volume group receiving a profit of 2.5 cents per pound."[3] The returns per pound of chicken were nearly the same for both New York-dressed and drawn, whereas the returns per man-hour were higher for the New York-dressed operators (Table 174).

Table 174

	New York-Dressed Only			Drawn Only		
	Fewest Chickens	Most Chickens	All	Fewest Chickens	Most Chickens	All
Number of farms	38	39	77	31	32	63
Average number of chickens dressed per farm	1215	9129	—	964	6878	—
Profit per pound (cents)	0.7	3.0	2.7	−1.1	2.5	1.8
Returns per pound of chicken (cents)	35.1	38.4	38.0	34.6	39.5	38.6
Returns per man-hour (cents)	72.1	134.8	114.1	52.3	106.9	88.2

Efficiency

The number of chickens dressed per hour is a measure of labor efficiency. Those farms dressing under 4 per hour spent in dressing lost \$0.017 per pound, whereas those dressing more than 11 per hour made \$0.06 per pound profit (Table 175).

Table 175

	Number Dressed per Hour Spent Dressing			
	Less than 4	4–7	8–11	More than 11
Number of farms	52	62	33	37
Averages per farm				
Hours of dressing	926	800	636	582
Number of chickens dressed	1913	4133	5832	9738
Chickens dressed per hour	2.1	5.2	9.2	16.7
Live weight dressed per hour (pounds)	9.2	19.8	33.1	53.4
Profit per pound (cents)	−4.7	2.3	3.0	6.0
Return per pound of live chicken (cents)	31.8	38.8	39.5	41.3

Markup

Not only is extra labor required beyond the live poultry price to prepare poultry New York-dressed or drawn, thus increasing the cost of such preparation, but also a price must be charged to cover the loss in dressing.

The amount of this markup above the live price is, therefore, a factor influencing profit (Table 176).

Table 176. Influence of Markup on Profit[2]

	Drawn Chickens			
Number of farms	35	23	28	21
Average markup above live price	66.9%	70.3%	107.1%	111.4%
Profit per pound	\$−0.09	\$−0.08	\$0.057	\$0.085
	New York-Dressed Chickens			
Number of farms	23	43	31	21
Average markup above live price	23.0%	32.1%	62.4%	65.7%
Profit per pound	\$−0.08	\$0.06	\$0.068	\$0.085

The *loss of weight* between New York-dressed and drawn poultry varies considerably. Searls[3] has provided likely averages (Table 177)

Table 177

	Percentage of Live Weight	
Class of Chicken	*New York-Dressed*	*Drawn*
Broiler	88	65
Fryer	88	68
Roaster	89	71
Fowl	90	72
Capon	90	73

Operating costs per pound were \$0.062 for New York-dressed poultry and for drawn poultry were \$0.075 per pound, for all farms.

Searls gives a test formula to determine the markup necessary for meeting the loss in weight and the extra cost, when the total operating costs per pound of fowl are known.

Assume a price per pound, live weight, for fowl of \$0.36, an operating cost per pound, live weight, of \$0.062, and a loss in weight of 10%. The price to be charged for New York-dressed fowl would be about \$0.47 to meet the extra costs. It may be arrived at in this manner:

$$\frac{\$0.36 + \$0.062}{0.9} = \frac{\$0.422}{0.9} = 0.4689, \text{ or } \$0.47$$

The formula to be used is:

$$\frac{\text{Value of live fowl per pound} + \text{Operating costs per pound}}{\text{Dressed weight of 1 pound of live chicken}}$$

$$= \text{Sale price per pound of New York-dressed fowl to meet extra costs}$$

Using the same formula and method for drawn fowl, the result would be:

$$\frac{0.36 + 0.075}{0.72} = \frac{0.435}{0.72} = 0.6041, \text{ or } \$0.60, \text{ sale price to meet extra costs}$$

Determining Total Operating Costs

Searls also presents formulas for determining the total operating costs of dressing and drawing chickens when the labor cost per hour is known. In his study labor was 56.5 per cent of the total operating cost in preparing 18 pounds of New York-dressed chicken and 60 per cent in preparing 14 pounds of drawn chicken.

Assuming that labor will average about the same number of pounds per hour, he finds the labor cost per pound by dividing the labor cost per hour by 18 for New York-dressed and by 14 for drawn chicken. The next step is to find what 100 per cent, or total, operating costs will be by dividing the labor cost per pound by 0.565 and 0.60, respectively.

The formulas for New York-dressed chickens:

$$\frac{\text{Labor cost per hour}}{18} = \text{Labor cost per pound}$$

$$\frac{\text{Labor cost per pound}}{0.565} = \text{Total operating cost per pound for New York-dressed chicken}$$

The formulas for drawn chickens:

$$\frac{\text{Labor cost per hour}}{14} = \text{Labor cost per pound}$$

$$\frac{\text{Labor cost per pound}}{60} = \text{Total operating cost per pound for drawn chicken}$$

Costs of Processing Poultry in Large Plants *

Average costs per pound of processing chickens (chiefly broilers), live to New York-dressed, for 10 plants, 1947–1948, is shown in Table 178.

Table 178

	Cents	
Overhead		1.44
General	1.01	
Direct	0.43	
Direct costs		7.54
Shrinkage [a]	2.74	
Labor	2.40	
Hauling materials	0.70	
Feeding materials	0.62	
Dressing materials	0.05	
Cooling and packing materials	0.69	
Selling	0.34	
Total		8.98

[a] Based on live cost of 31.86 cents per pound.

Average costs per pound of eviscerating chickens (chiefly broilers), New York-dressed to eviscerated, for 7 plants, 1947–1948 † is shown in Table 179.

Table 179

	Cents	
Overhead		1.66
General	1.31	
Direct	0.35	
Direct costs		15.11
Shrinkage	10.51	
Labor	2.69	
Packing materials	1.33	
Ice and freezer	0.34	
Freight out	0.24	
Total gross		16.77
Less inedible viscera sold		0.06
Total net		16.71

* Preliminary unpublished data of the Farm Credit Administration, provided by John J. Scanlan.

† Based on New York-dressed cost of 37.29 cents per pound.

Scanlan states:

Our study of 15 large dressing plants showed an average investment of $16,051 in all assets for each 1 thousand pounds of daily New York dressing capacity. The average investment in fixed assets was $7135 per 1 thousand pound capacity. There was a wide range in plant investment due to the fact that some associations merely New York dressed while others eviscerated and had cold storage and costly sharp freeze facilities.

Eggs

Costs of producing eggs are given elsewhere in this book. Costs ordinarily include all operations of preparing the eggs for the market, such as gathering, cleaning, sorting for size, and packing.

The cost for candling in the event eggs are sold from the farm directly to consumers is an extra cost entailed, and this, presumably, and the carton cost would be met and a profit realized above the extra cost.

An important phase of marketing eggs from the farm is the price received in relation to the market-price quotation. Naturally, this varies with receivers who must meet their costs and make a profit. The receiver may have a special market for eggs of high quality or he may not. In either case, his ability to pay more or less to the producer depends on his costs, outlets, and integrity.

Costs involved between the producer and ultimate consumer vary also, depending upon the transportation distance, the number of marketing agencies involved, and the costs and profits with which each contends.

Prices paid to producers for eggs in various sections of the United States have been studied and reported under the Research and Marketing Act of 1946. The northeastern report [4] included the New England states of Connecticut, Maine, and Massachusetts. The Middle Atlantic states are New York and Pennsylvania. Information was provided by 145 wholesale receivers. The prices paid to producers by receivers were compared to the top market quotation for the same day. The Boston quotations were used for New England and those at New York for New York and Pennsylvania.

Producers of fine brown eggs in New England were receiving within $0.02 of the top market. In the summer of 1948 the price was high.

Earle gives 4 possible reasons for the narrow margin:

1. One less handler between the producer and the buyer in the city market than in the Middle Atlantic area.
2. The buyers who often sold directly to stores may have received a price above the wholesale quotation and could, therefore, pay more.

3. Operating cost per case may have been less, as the volume of eggs handled by the New England buyers was greater.
4. More plants charged for the cases provided. The price for eggs may have been somewhat higher, as the price of the case was later deducted.

Producers in New York and Pennsylvania received $0.055 under the New York quotation for brown eggs and $0.049 under for white eggs (Table 180).

Table 180. Differences between Quotations Given for Prices Paid Producers for Best Quality Large Eggs and Top Market Prices, Boston and New York,[a] 145 Northeastern Wholesale Egg Buyers, One Week, Summer 1948 (Cents per Dozen)

	Farm Price		*Top Market Price*		*Amount Farm Price Was Below Market Price*	
Area	*White*	*Brown*	*White*	*Brown*	*White*	*Brown*
New England	—	72.3	—	74.3	—	2.0
Middle Atlantic	64.2	63.5	69.1	69.0	4.9	5.5
Northeast	64.2	66.3	69.1	70.7	4.9	4.4

[a] In the Boston market, the prices quoted in the *Daily Market Report*, published by Dairy Branch, Production and Marketing Administration, United States Department of Agriculture, were used; in the New York market, prices quoted in the *Producers' Price-Current*, published by Urner-Barry Co., were used.

A second study under the same act was made in the North Central states and Kentucky.[5] The North Central states were divided into three areas to expedite the survey.*

Eastern Area	*Central Area*	*Western Area*
Indiana	Illinois	Kansas
Michigan	Iowa	Nebraska
Ohio	Minnesota	North Dakota
	Missouri	South Dakota
	Wisconsin	

Prices given are those from country buying stations in these areas. Prices for graded eggs were compared with those for midwestern mixed eggs in New York City for corresponding days. Farmers received from $0.092 to $0.101 less at the farm than the New York quotation.

* Figures from other sections than Northeastern and North Central states were not available.

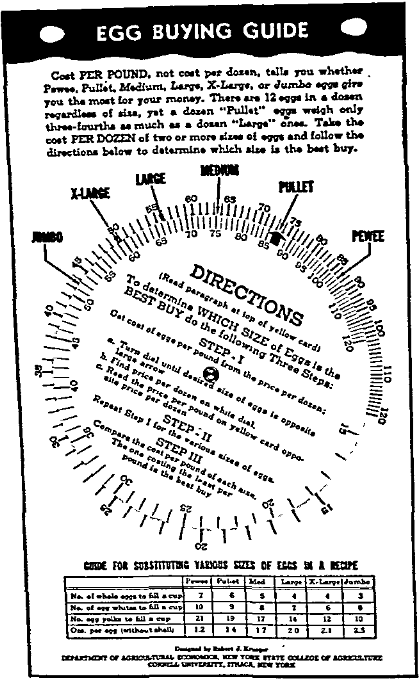

FIG. 120 Egg-buying guide. From July to December prices of eggs per dozen in the various sizes differ considerably. Consumers can, in that period, buy more advantageously by the pound, since the amount of egg meat varies greatly in one dozen eggs of the different sizes. To convert dozens at a given price

Fig. 121. Sorting and sizing eggs in the Yorkshire egg-packers plant, Yorkshire, England. (*Courtesy Alan Thompson, Editor,* Poultry Farmer, 189 *High Holborn, London, W.C.* 1.)

to the price per pound, divide the price by the total ounces per dozen eggs and multiply the result by 16 ounces. Each size comprises three weights in ounces per dozen as follows:

Jumbo	30–31–32
Extra large	27–28–29
Large	24–25–26
Medium	21–22–23
Pullet	18–19–20
Peewee	below 18

A dozen eggs seldom contains all eggs of similar weight, but may include some of all three weights. Therefore, the central figure is often used as the mean weight of a dozen eggs of the size to be considered.

To illustrate, if one dozen large eggs are sold at $0.75 per dozen, the price per pound is $0.48. ($0.75 ÷ 25 ounces = $0.03 per oz. × 16 = $0.48.)

The white section of the egg-buying guide shown is a rotating dial on which *the price per dozen is printed.* When the arrow is placed on the size involved, the figure on the card opposite the price per dozen is the price per pound.

The eastern area states, being somewhat closer to consuming centers, had a smaller spread in price, which was to their advantage. Western area states had the greatest differences (Table 181).

Table 181. Average Differences between Highest Price Paid Farmers by Country Buying Stations for Top-Grade Eggs, and the Top Quotations for Midwestern Mixed Eggs in New York, by Areas, North Central States, 1948

	Average Price (Cents per Dozen) Paid Farmers Was Below Price in New York in		
Area	*Spring*	*Summer*	*Fall*
Eastern	4.6	3.5	8.0
Central	9.7	10.7	11.0
Western	10.4	15.8	19.0 *
Region	9.2	10.4	10.3

* Average for 2 stations.

Ungraded eggs were compared in price with current-receipt egg prices at Chicago for identical periods. In most cases the difference between these two prices varied from $0.068 below in the summer for the western area to $0.075 above in the fall for the eastern area (Table 182).

Table 182. Average Differences between Top Prices Paid Farmers by Country Buying Stations for Ungraded Eggs, and the Top Quotations for Current-Receipt Eggs in Chicago, by Areas, North Central States and Kentucky, 1948

	Average Price (Cents) Paid Farmers above (+) or below (−) Price in Chicago in		
Area	*Spring*	*Summer*	*Fall*
Eastern	−2.6	+4.7	+7.5
Central	−4.4	−5.2	+0.2
Western	−5.3	−6.8	−1.3
Region	−4.3	−4.4	+1.2
North Central States and Kentucky	−4.5	−4.4	+1.4

Distribution of the Consumer's Dollar

Many chickens and eggs in the United States are shipped long distances. Long shipments are likely to increase the number of agencies through which the poultry pass. Each agency, although essential, absorbs a portion of the consumer's dollar. The more direct the passage and the lower the number of agencies involved from producer to con-

sumer, the larger proportion of the consumer's dollar the producer may receive.

An interesting estimate [6] of the distribution of the consumer's dollar for chickens and eggs by agencies, functions, and cost items is given for

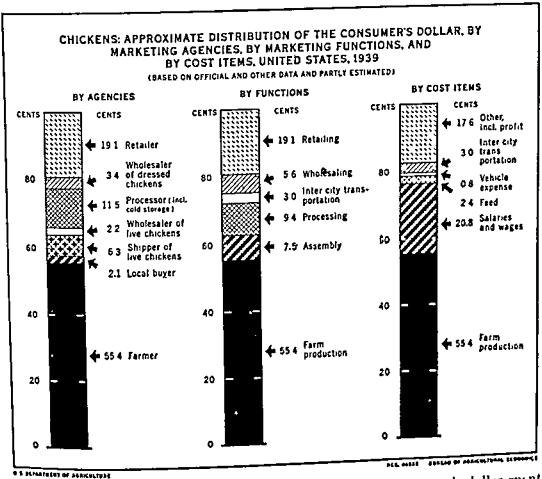

Fig. 122. Retailers accounted for the largest share of the consumer's dollar spent for chickens in 1939, receiving \$0.191 out of the entire farm-retail margin of \$0.446. Local buyers and shippers of live chickens together received \$0.084; processors plus cold storage, \$0.115; and wholesalers of live and dressed chickens, \$0.056. Salaries and wages were of greatest importance among the individual cost items, amounting to \$0.208 of the consumer's dollar.

1939 in *U.S.D.A. Bulletin* 969. The figures show the producer's share in marketing chickens to be \$0.554. The amounts received by local buyer, shipper, wholesaler, processor, and retailer account for the other \$0.446.

The jobs performed by the agencies of assembling, processing, transporting, wholesaling, and retailing also account for \$0.446 of the dollar. When the jobs of the agencies are broken down into the actual cost items, we see that salaries and miscellaneous costs, including profit, account for large shares of the dollar (Fig. 122).

It is not possible to combine all egg-marketing conditions and obtain figures that will accurately portray the actual situation in the distribution of the consumer's dollar. However, a breakdown as shown in Figs. 123 and 124 gives an idea of the complexity of the marketing proc-

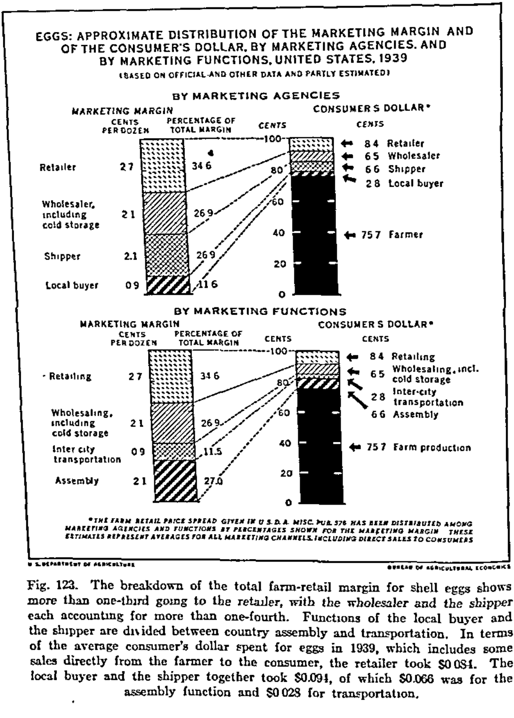

Fig. 123. The breakdown of the total farm-retail margin for shell eggs shows more than one-third going to the retailer, with the wholesaler and the shipper each accounting for more than one-fourth. Functions of the local buyer and the shipper are divided between country assembly and transportation. In terms of the average consumer's dollar spent for eggs in 1939, which includes some sales directly from the farmer to the consumer, the retailer took $0 084. The local buyer and the shipper together took $0.094, of which $0.066 was for the assembly function and $0 028 for transportation.

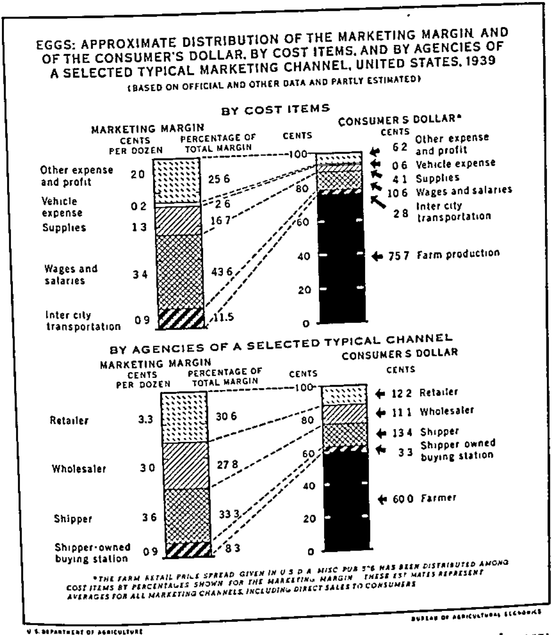

FIG. 124. Wages and salaries are the most important single cost item for eggs, accounting for nearly 44 per cent of the entire farm-retail marketing margin, and for 10.6 per cent of the consumer's dollar. The "typical channel" represents the movement of midwestern eggs to eastern cities, for which the total margin and retail price is larger, and the farmer's share is smaller, than for the national average of all marketings. The four agencies are in sequence: the shipper-owned local buying station, shipper, wholesaler-jobber, and retailer. The costs of these four agencies only are shown; any direct producer-to-consumer marketing is omitted. The producer in this instance receives less, or $0.60, and the four agencies $0.40.

ess and the reasons for the costs of placing the egg laid in central United States on the consumer's table in the East.

The estimate shows the producer receives about three-fourths of the consumer's egg dollar.[6]

The typical channel is most nearly representative of eggs moving from farms in the Middle West to eastern consumers. Since it is not an average of widely differing conditions, it probably represents a single situation reasonably well (Fig. 124).

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